ENGINEERING AND
BOILER HOUSE REVIEW

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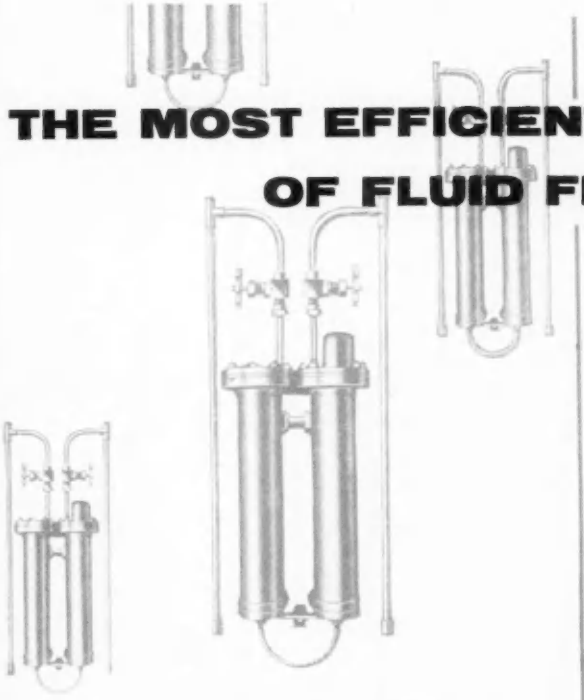
VOL. 74 NO. 6 • THE PIONEER STEAM JOURNAL • JUNE, 1959

Electroflo
Meters & Controls

THE MOST EFFICIENT MEANS OF FLUID FLOW MEASUREMENT



1 One operating principle — one general construction mode — for all fluids and gases under all conditions of measurement. Minimum service requirement.

2 Standardised, independent and interchangeable reading instruments — located at any distance from actual measuring point: separated, grouped or duplicated to meet any operating or supervisory requirement.

3 Linear scales. Square root extraction effected by parabolic contour of resistance element.

4 Full 4" mercury rise.

5 Unrestricted mercury column gives maximum sensitivity to flow rate changes. Accurate to within ±0.5%. Differential pressure change modifies circuit resistance — see diagram. Conductance proportional to flow rate: easily checked in situ by substitution of standard resistance.

6 A.C. mains operation: unaffected by supply voltage and frequency variations.

7 NO CASTINGS. — Interchangeable tubular manometer with drop-forged ends. Readily available for any specified line pressure. No glands: integral equalising valve: over-range protection and dirt traps

8 High-speed, frictionless integration. Integration is totalising conductance meter measuring amperes x time/volts.

9 Wide choice of interpretive instruments — see illustrations.

10 Equipped for data reduction: control circuits and available for long distance transmission. Also accepts 3-15 p.s.i. pneumatic signal. Further particulars on application

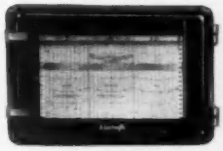
'Miniature' instruments for graphic consoles and comprehensive supervisory panels.

Model No. 365 6"x 6" rate of flow indicator

Model No. 259 6"x 6" high-speed integrator

Model No. 199 4", 1000-hour strip chart recorder

Model No. 355 12" diam. rate-of-flow indicator



Model No. 350 multi-point, 12" continuous roll chart recorder

Model No. 224 12" diam. recorder: 10½" diameter linear chart

Model No. 223 10" scale edgewise type rate-of flow indicator

TENS OF THOUSANDS IN OPERATION IN EVERY CLASS OF INDUSTRY THROUGHOUT THE WORLD. FOR FURTHER PARTICULARS, ASK PUBLICATIONS DEPARTMENT FOR CATALOGUE No. 65

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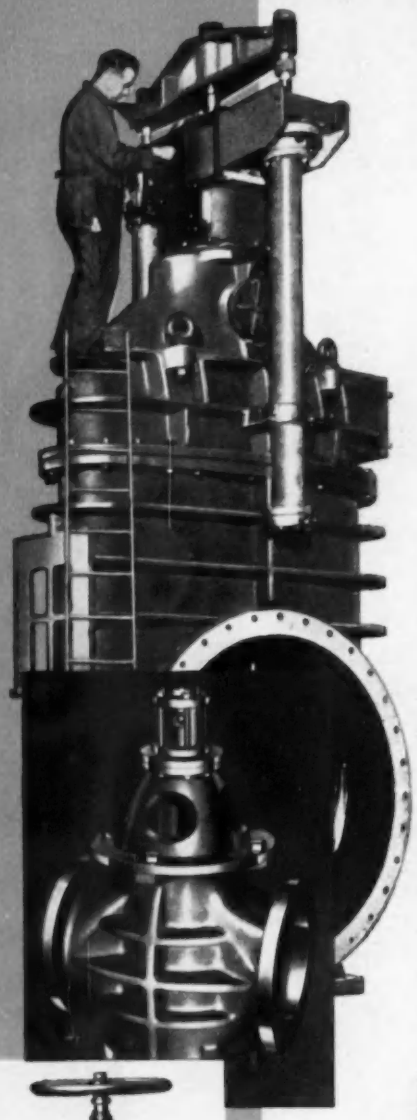

Valve Actuation by Lockheed Hydraulics

THESE ILLUSTRATIONS SHOW:

1. A 66″ sluice valve actuated by two Lockheed hydraulic cylinders during assembly.
2. A plug valve actuated by a Lockheed hydraulic semi-rotary slave giving 90° movement. Such an arrangement is equally suitable for butterfly valves.
3. A gate valve actuated by a Lockheed rotary hydraulic motor with a hollow shaft to accept either rising or non-rising spindle and to provide for over-riding manual control if required.

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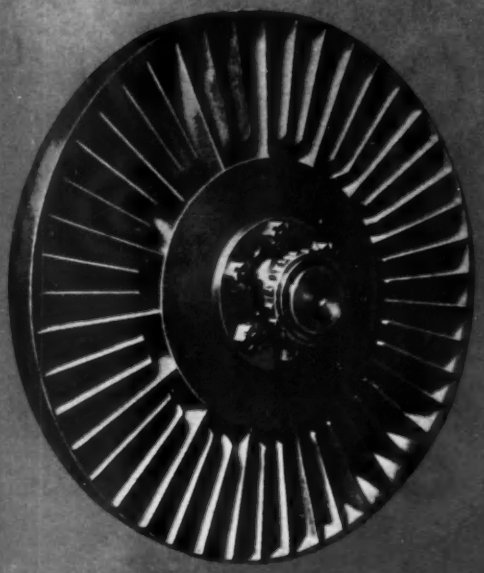

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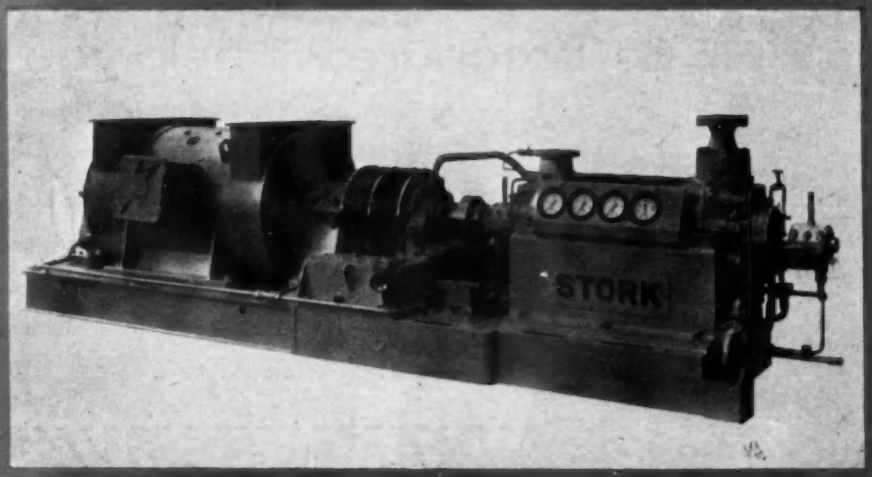

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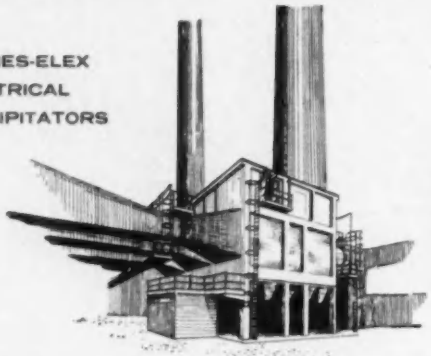

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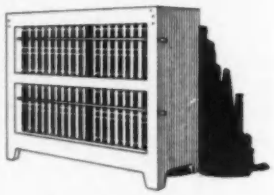

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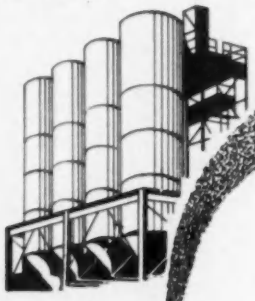

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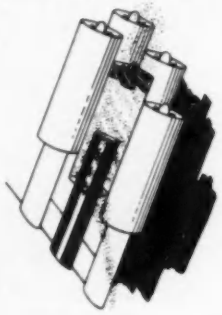

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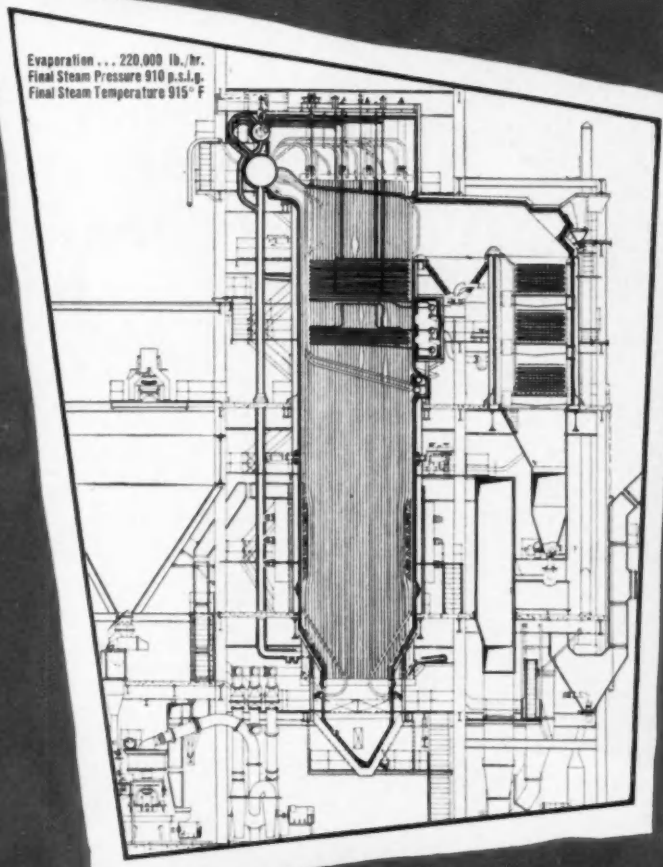

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An example of an installation at a large British paper mill is illustrated here.

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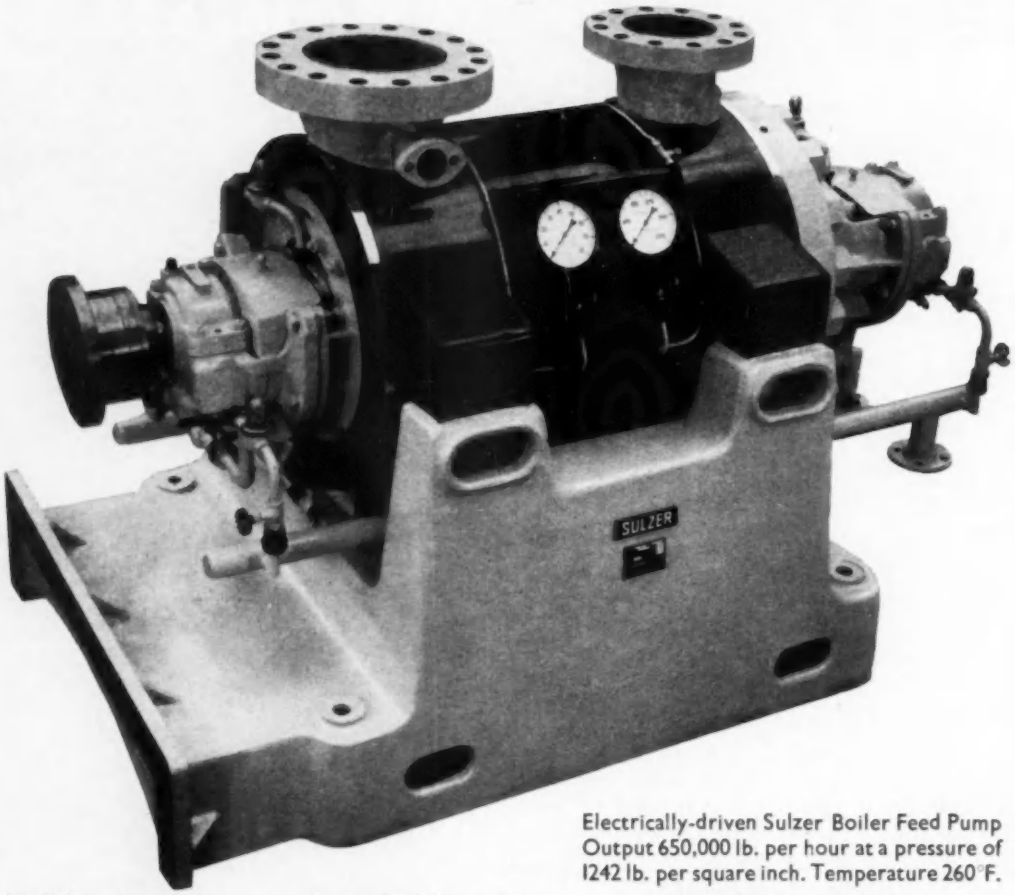

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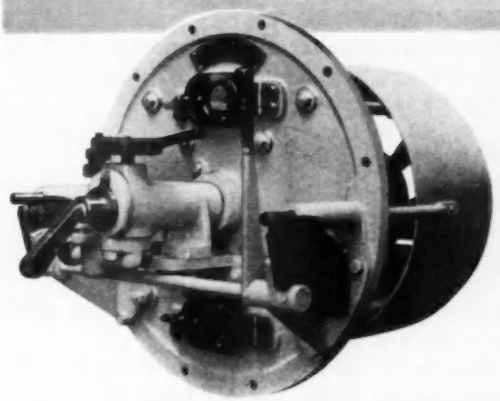

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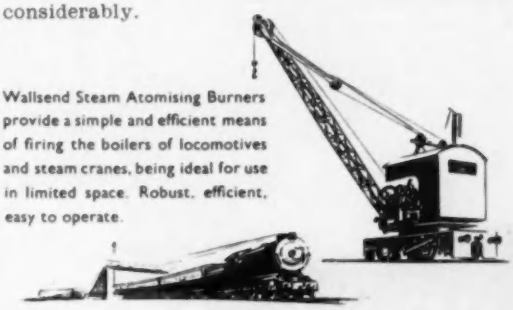

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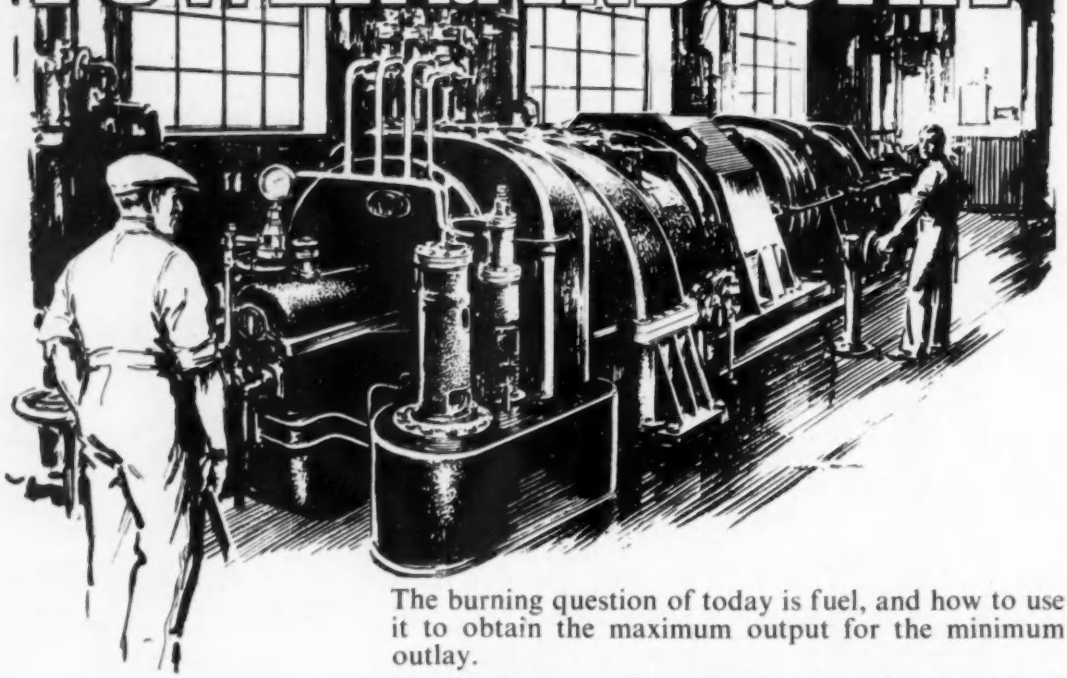

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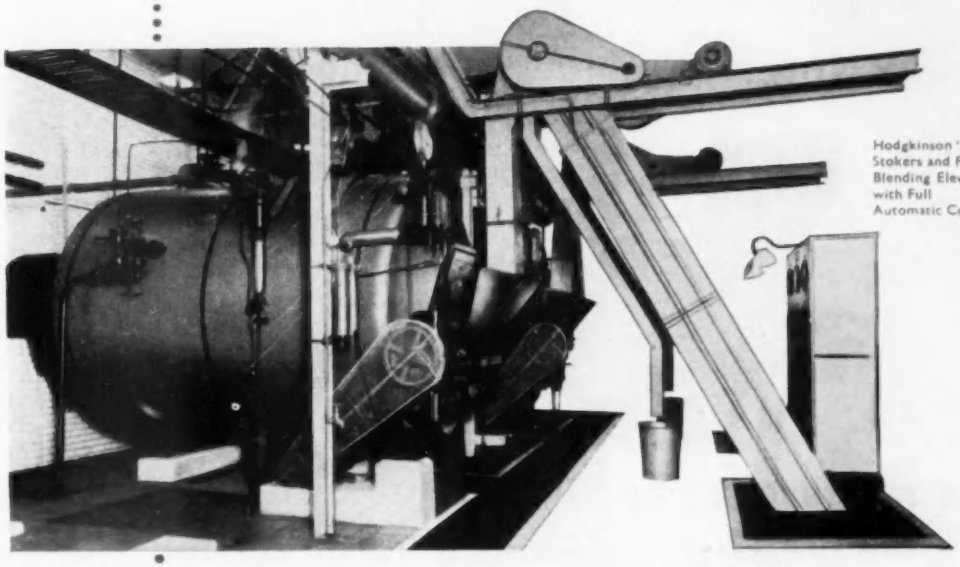

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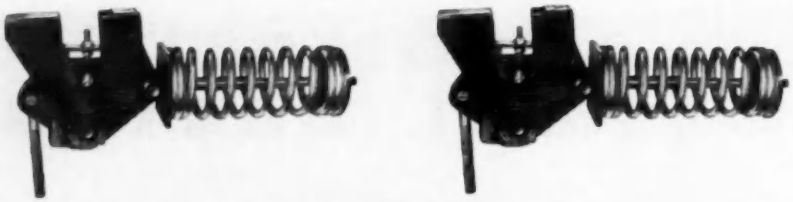

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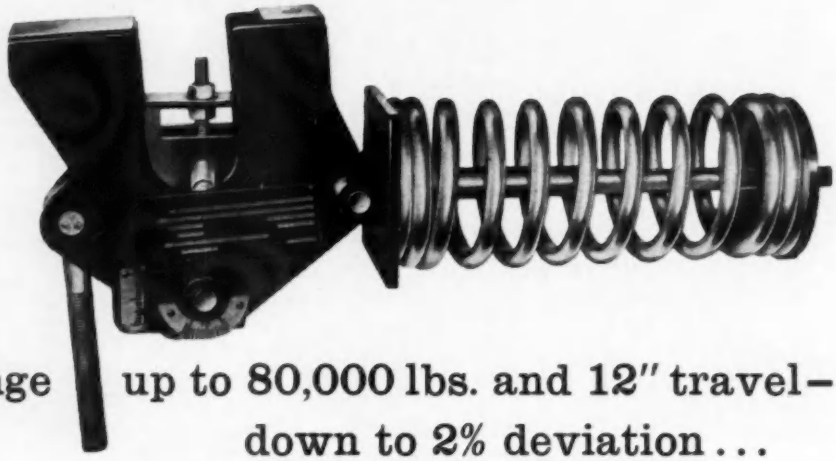

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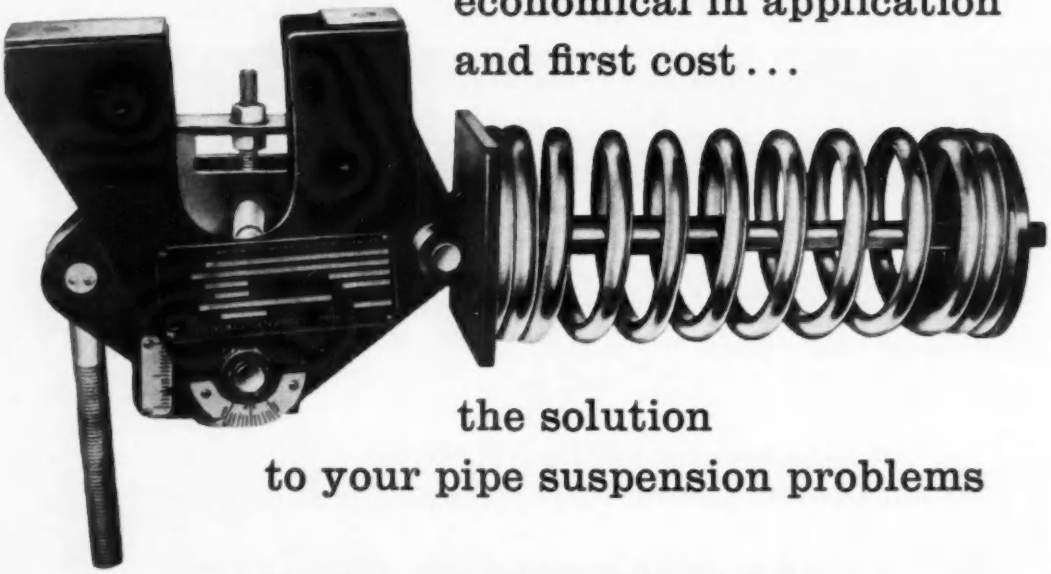

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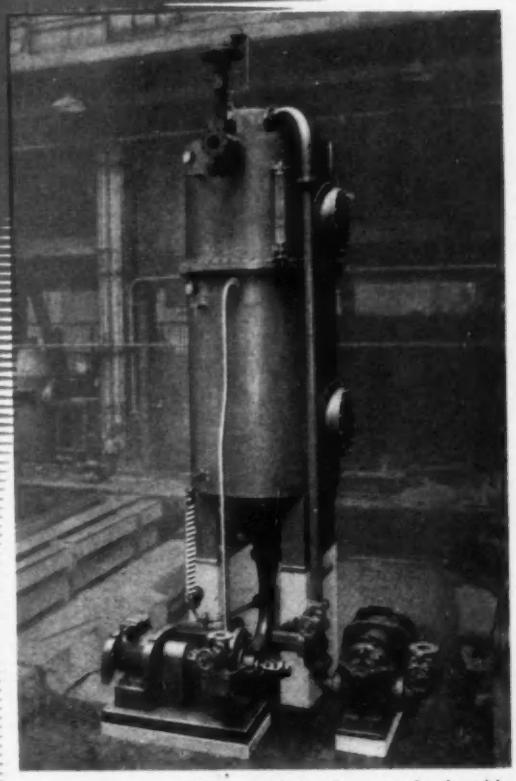

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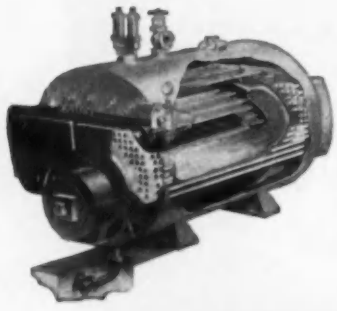

A five year plan

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evaporations up to 17,500 lb. per hour.

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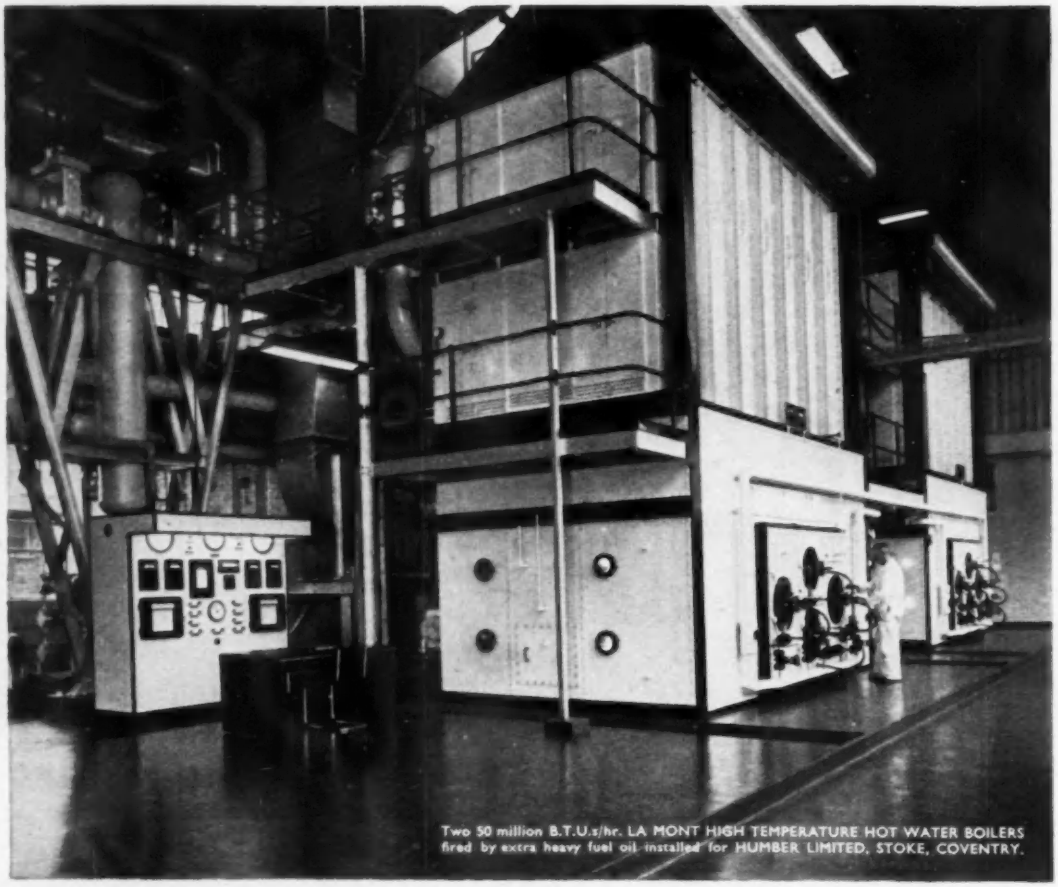


Two 50 million B.T.U.s/hr. LA MONT HIGH TEMPERATURE HOT WATER BOILERS fired by extra heavy fuel oil installed for HUMBER LIMITED, STOKE, COVENTRY.

LA MONT Hot Water Boilers are the most efficient, flexible and compact units available for industrial heating and district heating requirements.

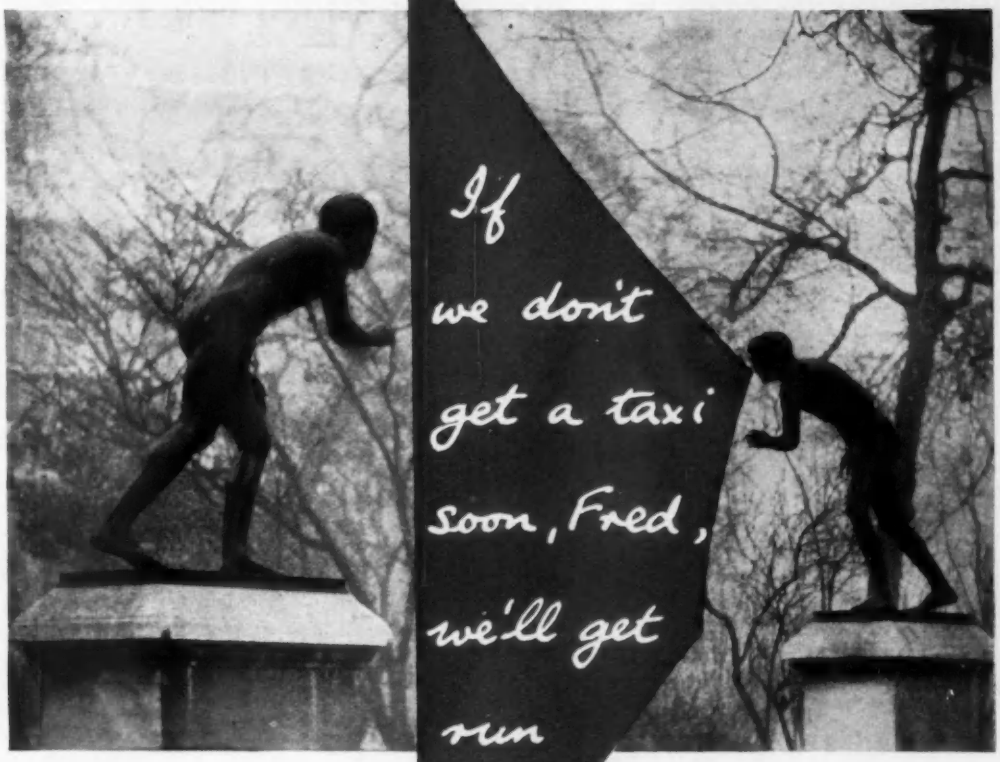
Suitable for coal, oil, creosote pitch or gas firing and for utilising the waste heat in flue gases from all kinds of industrial processes.

LA MONT STEAM GENERATOR LIMITED

HEATHER PARK DRIVE, WEMBLEY, MIDDX.

Telephone: WEMBLEY 8821

B2



Knowledge of the bare facts about compressed air is worth putting your shirt on—if you're prepared to draw the right conclusions.

Air itself is free but compressed air is costly. It can take up to 20 horse-power to compress 100 cubic feet a minute of free air—power which can so easily blow to waste through faulty valves, hoses, joints and so on.

Economic and efficient usage demands a proper distribution system with correctly sized pipes, and a proper choice of separators and drain traps.

Where inter-coolers and after-coolers are installed it is possible to waste large quantities of cooling water. Simple automatic temperature control offers notable dividends in this field.

* * * * * * *

In short, the Spirax-Sarco principle of higher and better production at lower cost applies as much to compressed air as it does to process steam and hot water. So we believed when we wrote our Information Sheet No. 17. And so we believe now, having distributed so many thousand copies of it on request. Would you care to see whether you agree?

SPIRAX - SARCO

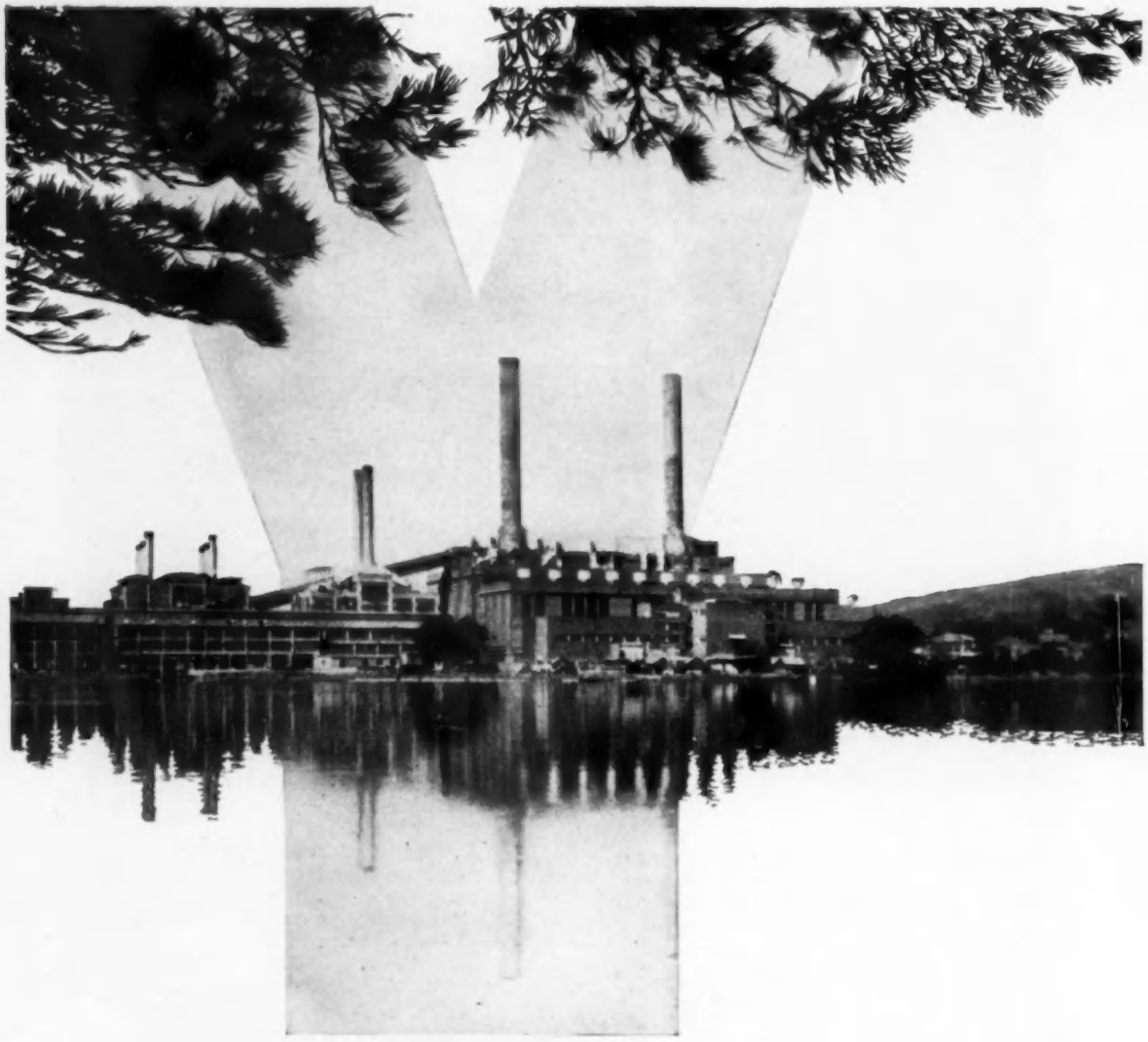
Please post . . . free copies of "Compressed Air."

NAME

ADDRESS

EB 659

Spirax-Sarco Ltd. Cheltenham, Glos. Phone: Cheltenham 5175-76 London: 28 Victoria Street, SW1 Abbey 6101-3832



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18 YARROW BOILERS
installed at Pretoria 'A & B'
Power Stations

NOW

2-550,000 lb per hour
950 lb per sq. inch

915°F pulverised fuel fired
YARROW boilers ordered by
Pretoria City Council for
the new power station at

ROOIWAL

YARROW AND CO. LTD. SCOTSTOUN · GLASGOW · W.4

YARROW AFRICA (PTY) LTD · PO BOX 619 · JOHANNESBURG · SOUTH AFRICA

Clean pair of heels

CAPOSITE Regd.

amosite asbestos preformed insulation

CAPOSITE means a clean and tidy site! No messy bits to stick to boots—Caposite is clean to cut and sweep away. It comes in light, easily handled, non-returnable cartons which make handy off-cut bins.

no mess-no waste

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MANCHESTER: Floor D, National Buildings, St. Mary's Parsonage, Manchester 3. Deansgate 6016-7-8
BIRMINGHAM: 11 Waterloo Street, Birmingham 2. Midland 6565-6-7
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CAPE

TA.3071

A.C. DIRECT-ON-LINE
CONTACTOR STARTER
WITH ISOLATING SWITCH

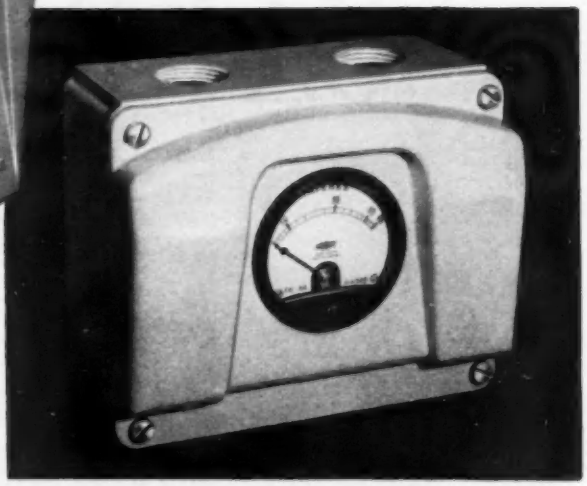
Up to 5 h.p. 200-550 volts 25-60 cycles

For three-phase or single-phase non-reversing squirrel-cage induction motors.

These well-established contactor switch-starters are now available fitted with mechanically interlocked three- or five-pole isolating switch. An ammeter unit and/or HRC fuse unit can also be accommodated in addition to, or in place of, the isolating switch unit.

The isolating switch can be supplied as a 3-pole 'on-load' switch rated at 30 amperes maximum (tested to break 100 amp. at 440 v.), or alternatively in 5-pole form with three main 30-amp. poles plus two normally open control-circuit auxiliary poles.

The starters comply in every respect with BS587, 1957 for 'Frequent Duty', i.e. forty starts per hour.



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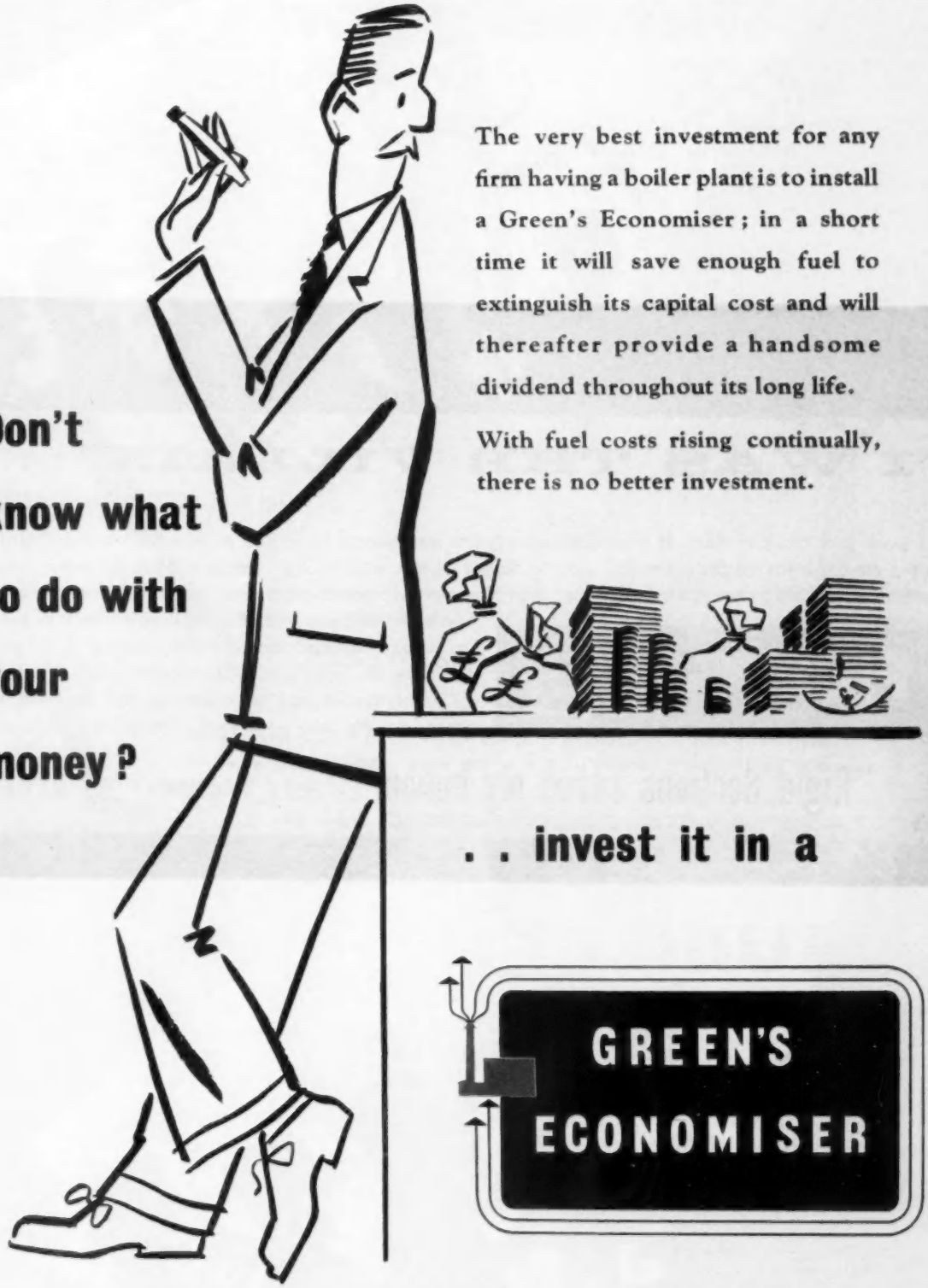
BRITISH THOMSON-HOUSTON

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED · RUGBY · ENGLAND

an A.E.I. Company

A5269



Don't know what to do with your money?

The very best investment for any firm having a boiler plant is to install a Green's Economiser; in a short time it will save enough fuel to extinguish its capital cost and will thereafter provide a handsome dividend throughout its long life.

With fuel costs rising continually, there is no better investment.

. . invest it in a

GREEN'S ECONOMISER

E. GREEN & SON LIMITED · WAKEFIELD

Makers of economisers for more than one hundred years

GE155

"I WAS THE VILLAIN"

—HOT WATER PIPE HISSES

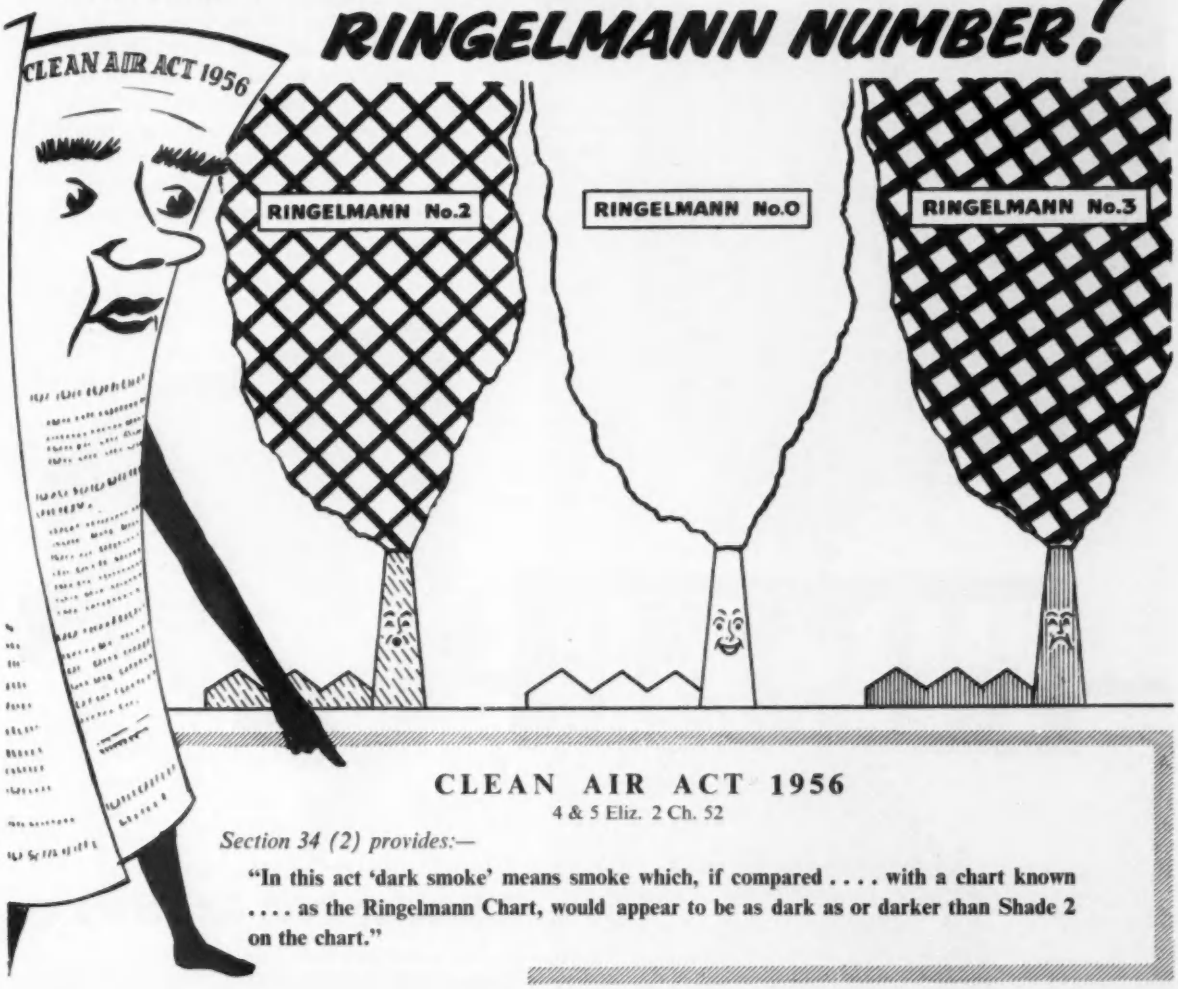
"I work in a block of flats. It is my job to carry hot water up to baths and radiators. But they might have called me Luke for all the warmth I used to deliver! I lost most of it on the way! First there was Fred, the boilerman, he used to warm his feet on me; then Mrs. Fred the housekeeper, used to drape her smalls over me. And so I cooled as I climbed. But now that's all changed. I'm decently dressed and decently behaved. Rigid sections of Fibreglass hold me tight—from boiler to tap. Now it's hot radiators and boiling baths for everyone, everywhere. All my own work—with Fibreglass of course!"

FIBREGLASS
TRADE MARK

"Rigid Sections saved my honour" *—HOT WATER PIPE REVEALS*

FIBREGLASS LIMITED · ST. HELENS · LANCASHIRE · ST. HELENS 4224

What is YOUR RINGELMANN NUMBER?



CLEAN AIR ACT 1956

4 & 5 Eliz. 2 Ch. 52

Section 34 (2) provides:—

"In this act 'dark smoke' means smoke which, if compared . . . . with a chart known . . . . as the Ringelmann Chart, would appear to be as dark as or darker than Shade 2 on the chart."

No. 3 RINGELMANN
IS A FLAGRANT OFFENCE UNDER THE ACT

No. 2 RINGELMANN
FAILS TO COMPLY WITH THE ACT

No. O RINGELMANN
IS ASSURED WITH THE

OLDBURY
CHAIN GRATE STOKER

which anticipated the Clean Air Act by 14 years

Today more than 5,000 Oldbury Stokers are serving industry, burning solid fuels in the widest variety, **EFFICIENTLY, SMOKELESSLY.**
Leave nothing to doubt. To comply with the Act, consult Edwin Danks at Oldbury or the nearest Branch Office.

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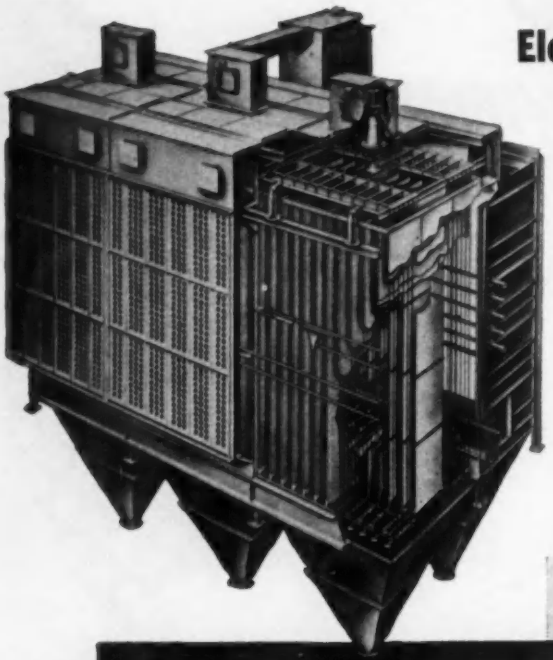
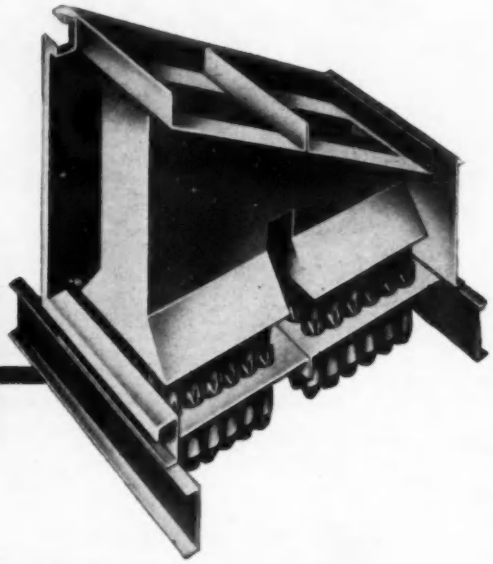
OLDBURY near BIRMINGHAM · Tel: (Stoker Division) Brierley Hill 7731
LONDON · CARDIFF · GLASGOW · LEEDS · MANCHESTER · NEWCASTLE-ON-TYNE



Electrostatic Precipitators

Made under licence from the Aerotec Corpn., U.S.A., these precipitators have an extremely high collection efficiency, low current consumption and many novel design features including screen-grid type collecting electrodes which minimise re-entrainment and consequent emission of dust. Manufactured in several combinations of width, height and length to suit available space in existing plants or most efficient usage of building volume in new constructions.

PD–KB



Multitubular Dust Collectors

Here is a dust collector which satisfies the ideal requirements of steam generator designers. It has a high collection efficiency at moderate resistance; maximum freedom from dust erosion; accessibility for maintenance and service; simple, low cost erection; flexibility of arrangement to meet space availability conditions. These collectors can be used in series with electrostatic precipitators and can be designed to match the precipitator inlet.

Induced & Forced Draught and Grit Arresting Fans

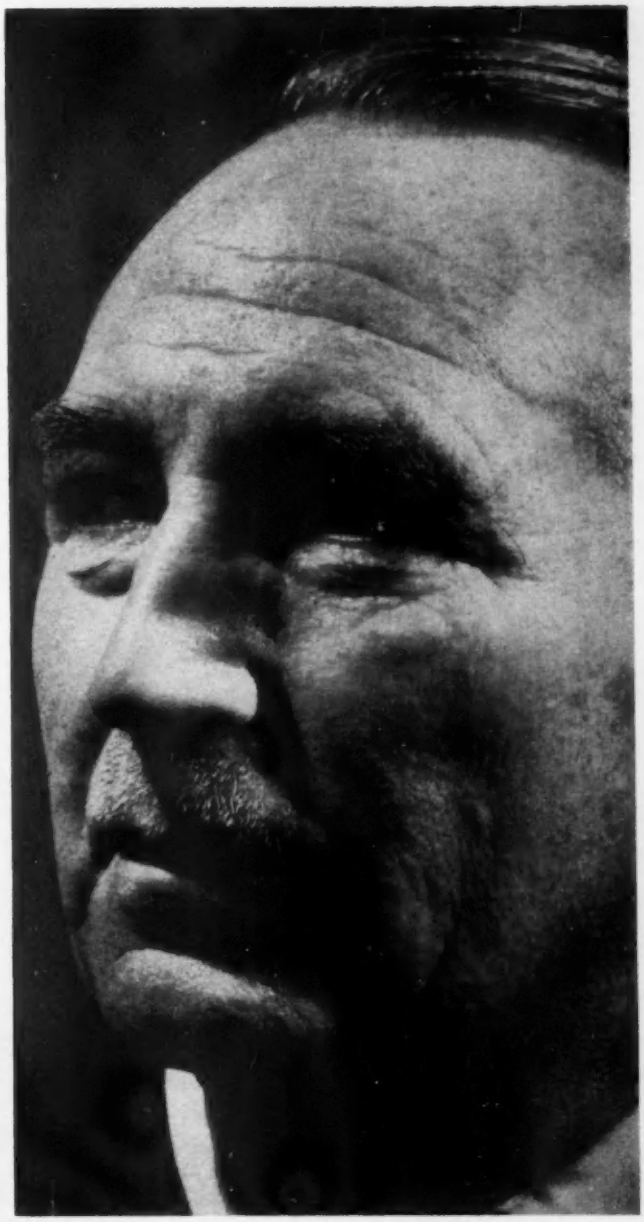
The product of over 75 years of experience, 'Tornado' induced and forced draught fans can handle any boiler draught requirements efficiently and reliably. The type A.R. aerofoil section backward bladed centrifugal fan, with peak efficiency of 90%, is only one of the many types (another is the combined induced draught and grit arrester) produced to deal with all classes of boilers from central heating to those in the largest power stations.

for CLEAN AIR

KEITH BLACKMAN LTD
(Incorporating Blackman Export Co Ltd)
MILL MEAD ROAD · LONDON N.17
in collaboration with Prat-Daniels (Stroud) Ltd., Whitecroft, Nailsworth, Gloucester

TA 971

CUSTOMERS OF
CARBORUNDUM



"Furnace output nearly doubled already"
says **Jack Masters**

The trade knows Jack Masters—as it knew his father and grandfather before him (and now his son is carrying on the Masters' tradition). Jack Masters has been 15 years with Enfield Rolling Mills—Britain's largest copper refiners. "*Results* are what interests me," he says, "and here's a case in point. Automation is speeding our production all round—so the furnaces have just got to cope with more input. This furnace was designed to handle 21 tons of copper billets an hour: we've pushed up the temperature and raised her output to nearly *double* that figure. And that's not the limit! How did we manage? Carborundum's refractories, of course: CARBOFRAX* for the muffle arch, and REFRAX* for the combustion chambers."

*Registered Trade Mark.

CARBORUNDUM can help YOU

Jack Masters knows what he's talking about—and in almost all the world's major industries there are men who talk about us as Jack does. They'll tell you that CARBORUNDUM help them make better products, cut costs, and speed production. In the battle for expanding markets overseas, high quality, low price, and early delivery dates are vital for victory. There are rich prizes for those who can meet the challenge. Abrasive and refractory products by CARBORUNDUM can help *you* to win them.

Products by **CARBORUNDUM** cut your costs

TRADE MARK

THE CARBORUNDUM COMPANY LIMITED, TRAFFORD PARK, MANCHESTER *Tel: Trafford Park 2381*

Hargreaves *in action!*

Truck-to-bunker delivery

The new HARGREAVES hopper-trucks fitted with conveyors deliver solid fuels in bulk, direct to bunker or firing floor.

This service cuts delivery and internal fuel-handling costs, and saves labour needed on other jobs. There are no obstructing piles of fuel; no dust; no mess.

HARGREAVES hopper-trucks deliver, to the required point, 7-8 tons of graded coal, or 5-6 tons of coke, in ten minutes.

HARGREAVES operate a free Technical Advisory Service, backed by comprehensive laboratory facilities, to advise upon the use of coal, coke and oil.

TAKE YOUR FUEL THE HARGREAVES WAY

HARGREAVES

FUEL DISTRIBUTORS

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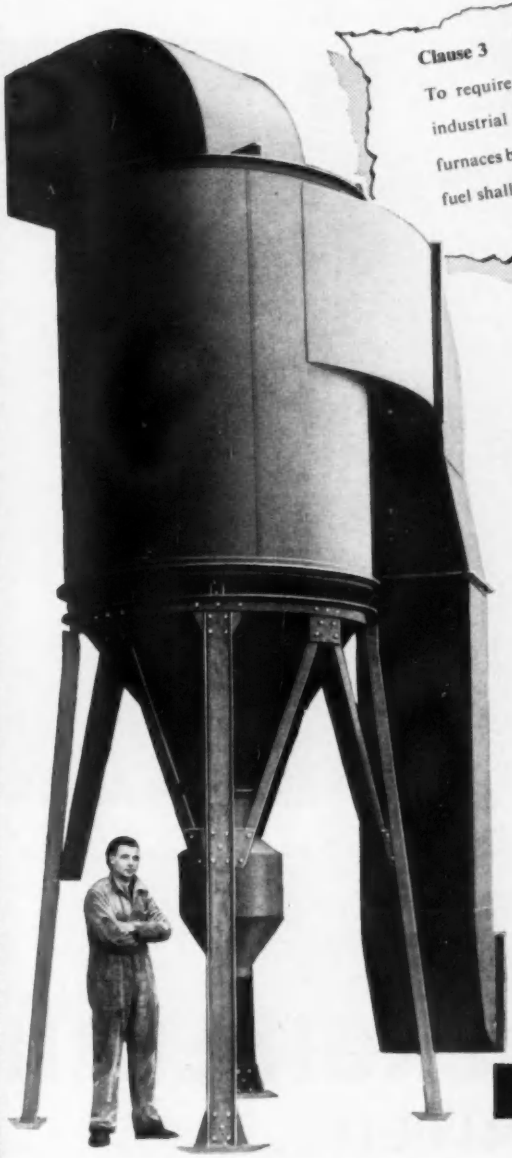
HDH 10805d

CLEAN AIR ACT 1956

Clause 3

To require that the emission of grit and dust from existing industrial furnaces shall be minimised and that new industrial furnaces burning pulverised fuel or large quantities of other solid fuel shall be provided with approved grit-arresting equipment.



Cyclone Patent Grit Arrester installed at Reading.

the

CYCLONE

GRIT ARRESTER

(Patented)

Clearly and economically meets the bill

For many years, Cyclone Equipment has led the field for efficiency and economy in the production of equipment related to air movement, purification and conditioning.

This Patent Grit Arrester embodies all the proven experience and resultant simplicity, efficiency and economy inherent in all our products.

It is your best 'Back answer' to the new Act and probably the least expensive.

May we send you literature?

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Telephone: SWINTON 2273 (4 lines)
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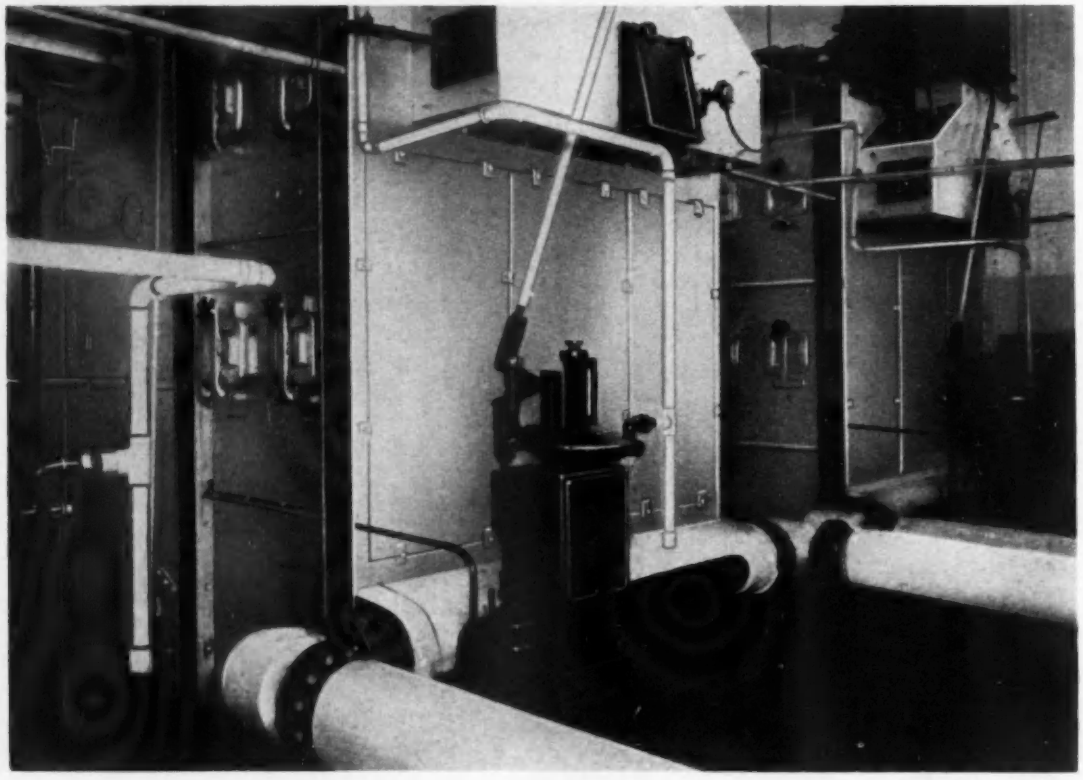
RADIANT WATER TUBE BOILERS

STEAM OR HOT WATER **STANDARD OR PACKAGED**

Delivered assembled or in sections as required



(By courtesy of the Air Ministry.)

Half rear view of two 7-million B.Th.U's/hr. BSF type H.P.H.W. packaged boilers.

**Please write for further particulars*

BOUËLLAT ENGINEERING LIMITED

BONDWAY HOUSE, BONDWAY, LONDON, S.W.8

Telephone: VICTORIA 9851 *Telegrams: BOUELLAT, LONDON-SW8*

MANCHESTER OFFICE: 205, LONDON ROAD, HAZEL GROVE, CHESHIRE. Telephone: STEPPING HILL 2475.
AUSTRALIA: HUDSON & WEST PTY. LTD., 213-219, BROADWAY, SYDNEY, NEW SOUTH WALES.

Damaging Slag and Carbon build-up is no longer a problem

DOHMseal, applied to existing refractory linings by brush or to new linings by the "Dipped Brick" technique, forms a tough resistant glaze that retards the build-up of Carbon and Slag and extends the "maintenance free" life of the lining.

These undesirable deposits will eventually form but DOHMseal ensures their easy removal without damage to the refractory lining.

Fuel saving and reduced maintenance costs result from the use of DOHMseal, which more than pays for the small expenditure incurred.

Repair refractory linings and fabricate monolithic refractory shapes with DOHMpatch—finish with DOHMseal.

CENTRAL ELECTRICITY AUTHORITY.
STOKE GENERATING STATION.

Close-up of slag adherance chipped away, showing DOHMseal treated bricks beneath. Without the application of DOHMseal the boilers need to be rebricked every six months.

By treating bricks with DOHMseal, which allows easy removal of slag, there is no necessity to rebrick for a year or more.

Write or telephone for full details:

MELLOR MINERAL MILLS LTD.

Etruria Vale,
Stoke-on-Trent,
Staffs.

Stoke-on-Trent 23441/5

ONE OF THE DOHM GROUP OF COMPANIES

H for economy . . .

H means fuel economy in hundreds of boiler installations, because it symbolises the design principle on which the success of the Senior H-tube Economiser depends. The practical expression of this principle takes the form of heat-exchange tubes with vertical cast iron H-shaped gill units assembled in such a way that:

(a) The heating surface is fully swept with maximum efficiency by the flue gases.

(b) The gas passages are straight, vertical and of uniform area.

As a result draught losses remain consistently low and efficiency consistently high throughout a long trouble-free life.

Senior H TUBE economisers

for cheaper steam

SENIOR ECONOMISERS LIMITED, 11 SOUTHAMPTON ROW, LONDON, W.C.1. TELEPHONE: HOLBORN 7543/4
Telegrams: Senioreco, Westcent, London

TA 9865

ADVANCED STEAM CONDITIONS

At Margam, Simon-Carves Ltd. are building for the Steel Company of Wales a Once-Through forced-circulation boiler to generate 240,000 lbs. of steam per hour at 3300 p.s.i. and 1060°F., with reheat to 836°F.

In Great Britain, this is the first Benson Once-Through boiler to be built for industrial application and the first example of such advanced steam conditions for commercial use in this country.

Howden are supplying two forced-draught fans, two induced-draught fans and one recirculating fan

HOWDEN

JAMES HOWDEN AND COMPANY LIMITED

195 SCOTLAND STREET, GLASGOW, C.5 and 15 GROSVENOR PLACE, LONDON, S.W.1

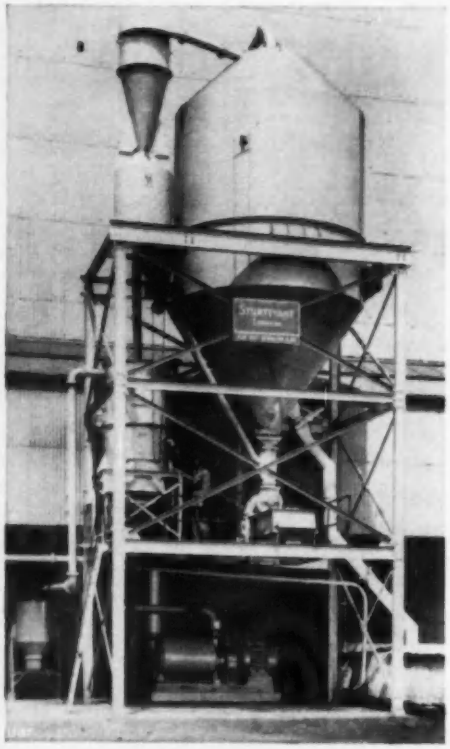
Flue dust and grit extraction

from boiler hoppers whilst under steaming conditions is

Continuous

with

STURTEVANT PLANT



- **No manhandling of dust and grit**
- **Cleaner conditions in the boiler house**
- **Dust and grit conveyed direct from boiler hoppers to central receiver**

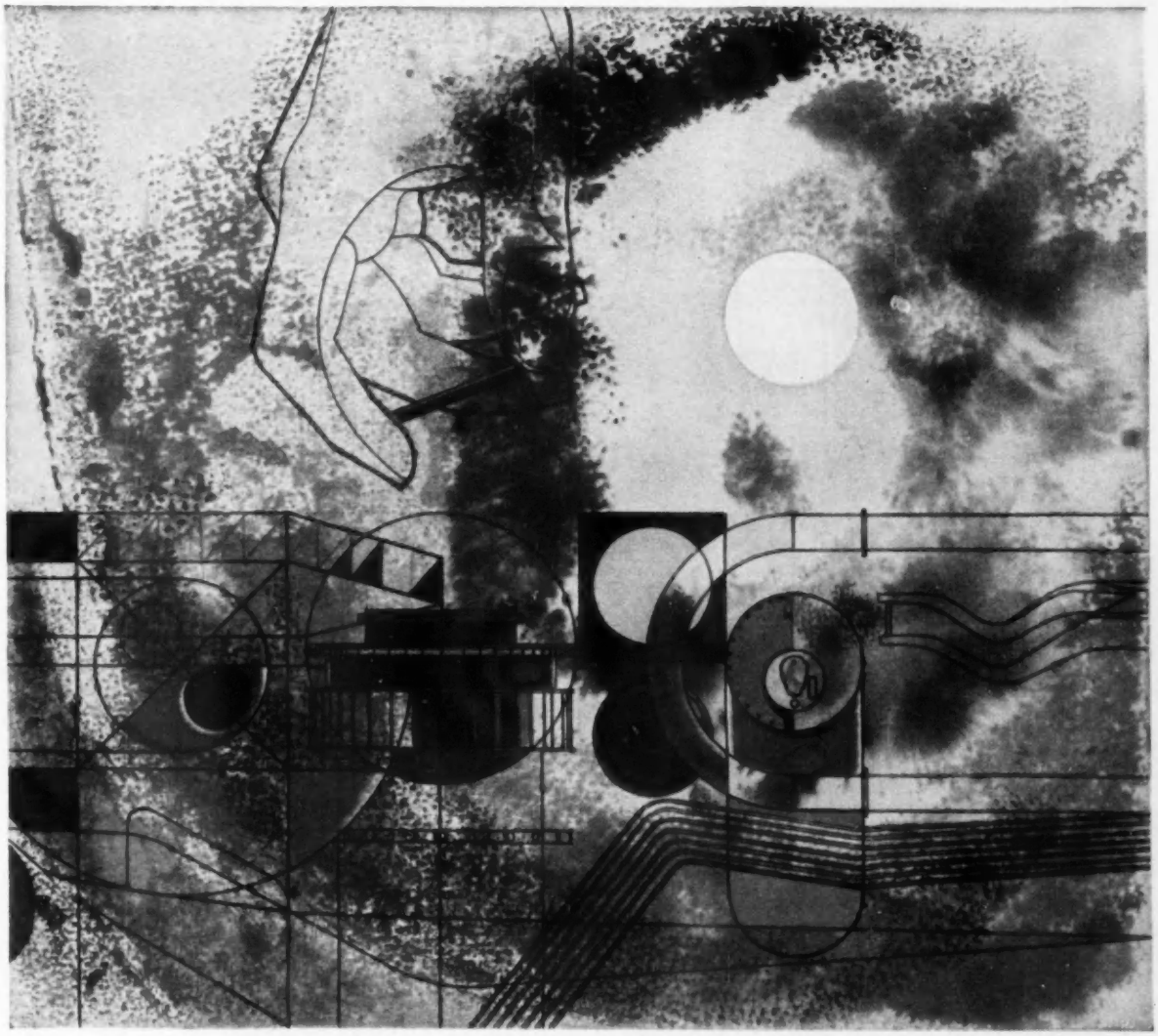
With the addition of a small bore piping system, complete vacuum cleaning of all surfaces can be carried out from hose connections placed at convenient points.

The above illustration shows a plant for six stoker-fired boilers for process steam at a large paper mill. Dust and grit from the hoppers (some of which are illustrated on the right) are collected at the rate of four tons per hour. Plant includes a Sturtevant Turbo-Exhauster and Receiver with dust conditioner to prevent dust escaping to atmosphere when discharging into a disposal lorry.

Further particulars may be obtained from our reference **Z/101/J**

STURTEVANT ENGINEERING CO. LTD.
Southern House, Cannon Street, LONDON, E. C. 4.

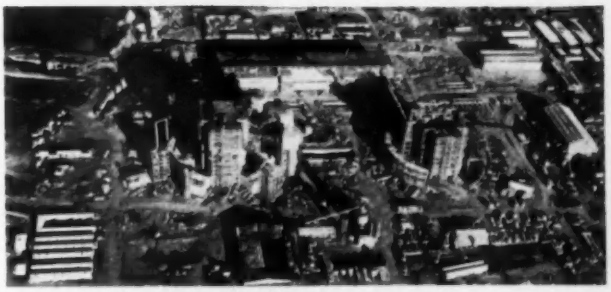
AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400 SUSSEX STREET SYDNEY N.S.W.



Cubism . . no, Circularity . . yes, Chaos . . never

Abstract art and " action " paintings have given some of us many a good laugh with their dazzle and chaos. Whatever we think of them, they do make news. John Thompson make boilers.

We are Engineers. Painting is not in our line, but " action " certainly is. Research, development, construction, progress. In the field of engineering we are always in action, always on the move.



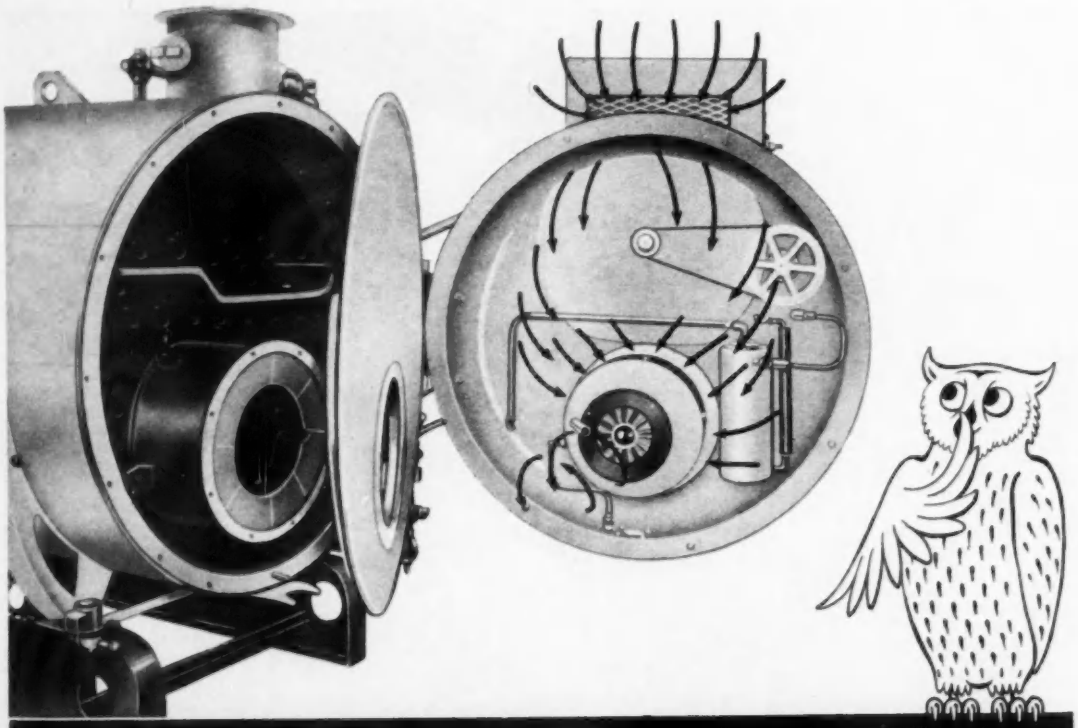
Heat Exchanger progress at Berkeley.

JOHN THOMPSON LIMITED
WOLVERHAMPTON · ENGLAND

JOHN THOMPSON GROUP

The John Thompson Group is experienced in the manufacture of a multiplicity of engineering products from shell boilers to nuclear power plant, from water treatment to instrumentation. Pioneers in many engineering techniques, we have produced order out of chaos.

A25



Marshalls made sure first....

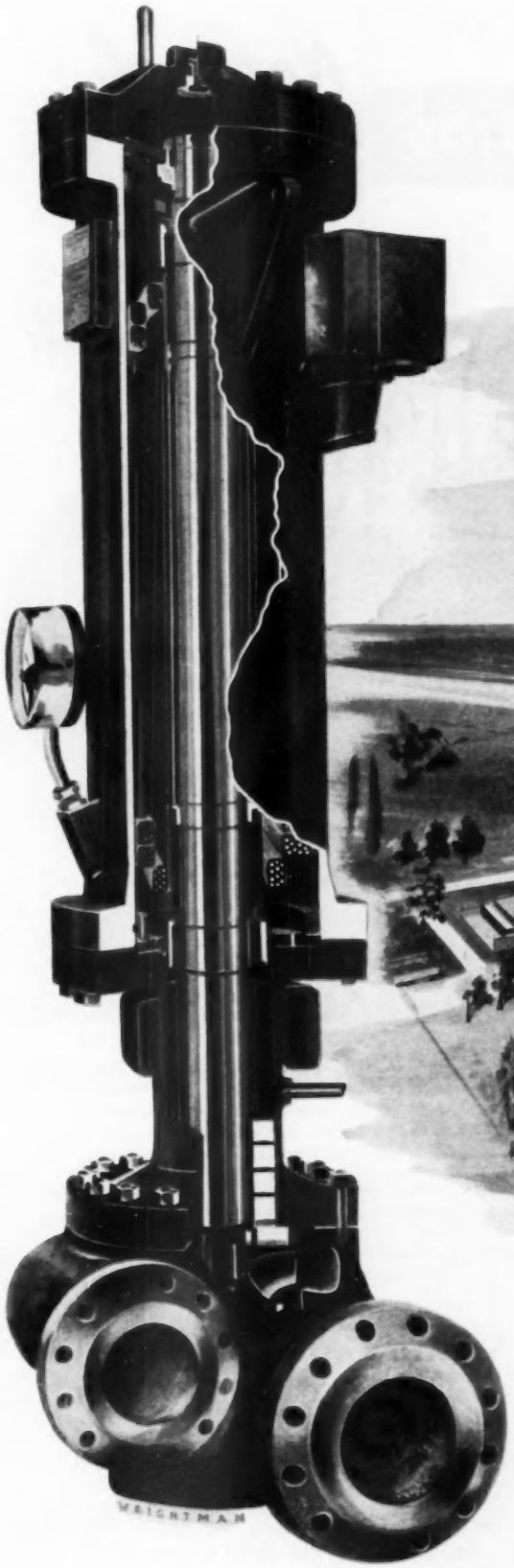
silent operation

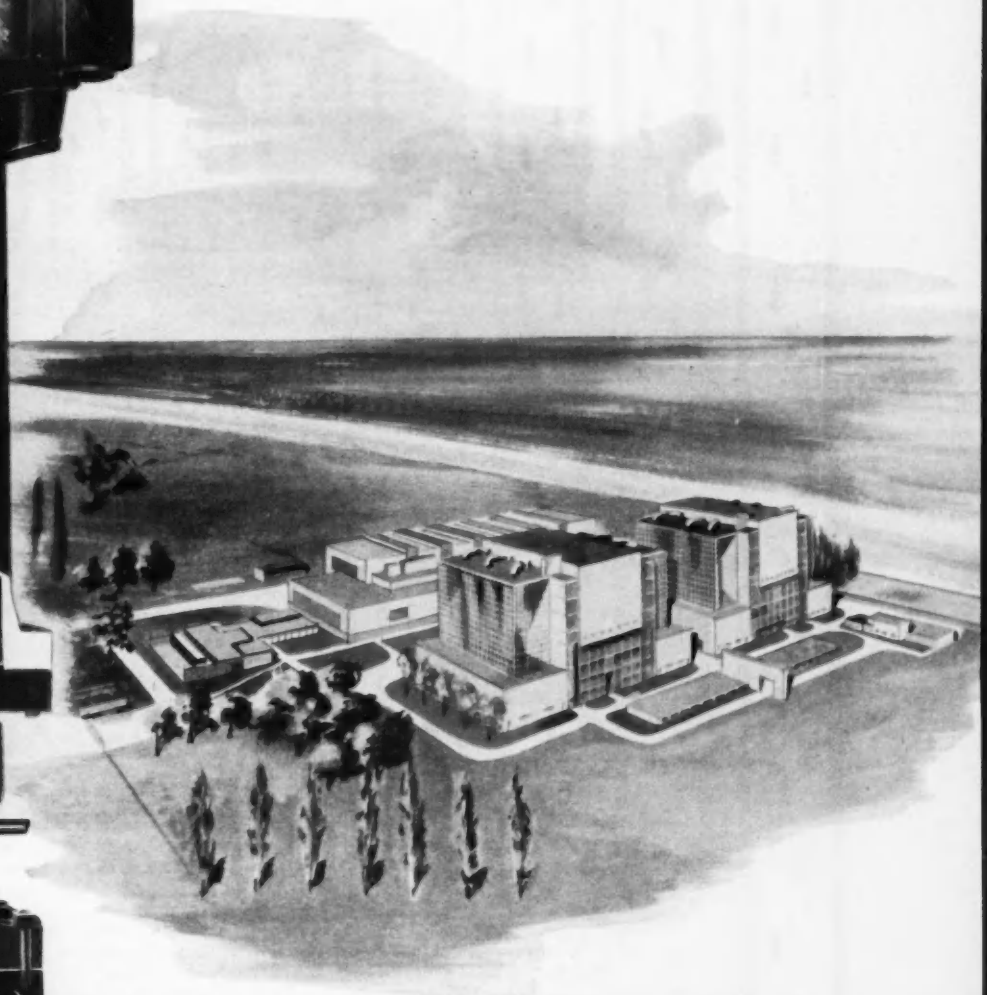
. . . at peak loads the Marshall Packaged Boiler more than meets the low noise levels required in schools, hospitals and institutions. The exclusive caseless fan design draws combustion air into the large Plenum chamber of the front head thus confining and deadening fan and air noises. For really quiet operation the Marshall Packaged Boiler leads the field. Low maintenance costs and extended life coupled with Marshalls unique on site starting service which ensures the correct adjustment of the Boiler under operating conditions, make Marshall Packaged Boilers your best investment. Send today for the latest bulletins.

MARSHALL

Cleaver-Brooks Packaged Boilers
– by Marshalls of Gainsborough

Thermal Engineering Division. Marshall Sons & Co. Ltd.,
3, Britannia Works · Gainsborough · Lincs.
Phone: Gainsborough 2301



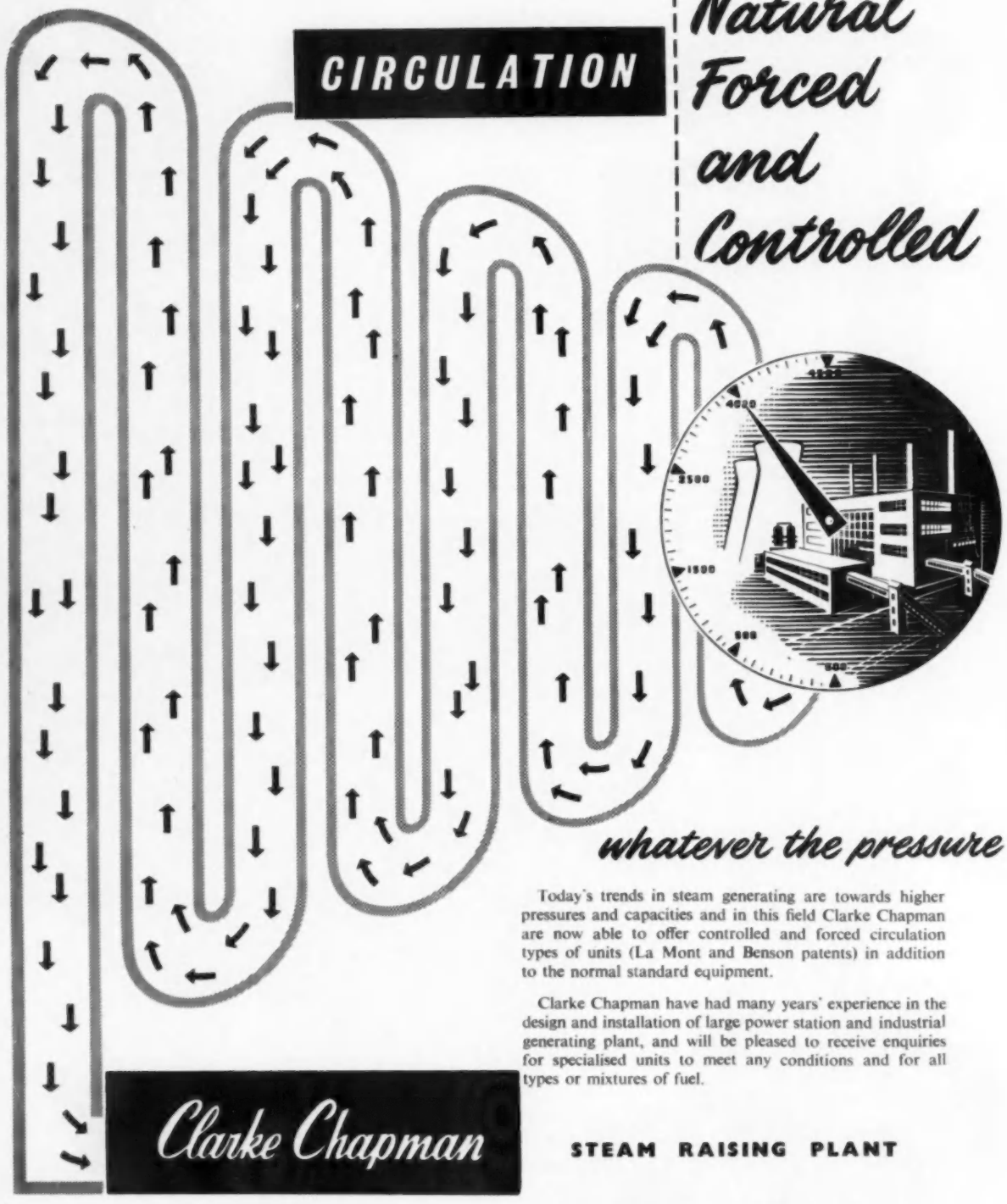


The CEGB Nuclear Power Station at Bradwell-juxta-Mare incorporates forty-eight Hayward Tyler glandless motor pump units in the high and low pressure secondary heat exchange systems. These pumps are supplied to the order of Clarke, Chapman & Co. Ltd., member Company of the N.P.P.C. principal Contractors.

HAYWARD TYLER

& CO. LTD., LUTON, ENGLAND. LUTON 6820

LONDON OFFICE: SALISBURY HOUSE, FINSBURY CIRCUS E.C.2 NATional 9306



Today's trends in steam generating are towards higher pressures and capacities and in this field Clarke Chapman are now able to offer controlled and forced circulation types of units (La Mont and Benson patents) in addition to the normal standard equipment.

Clarke Chapman have had many years' experience in the design and installation of large power station and industrial generating plant, and will be pleased to receive enquiries for specialised units to meet any conditions and for all types or mixtures of fuel.

Clarke Chapman

STEAM RAISING PLANT

Water-tube Boilers and Ancillary equipment. Raymond Bowl and "Resolutor" Milling Plant. Fusion Welded Pressure Vessels. Erection Winches. Ash Conveyors.

CLARKE, CHAPMAN & CO. LTD, Victoria Works, Gateshead, 8, Co. Durham

London Office: DUNSTER HOUSE, MARK LANE, E.C.3. Glasgow Office: 116 HOPE STREET, C.2.
Manchester Office: 8 KING STREET, 2.

STEIN *Refractories*

REFRACTORY CONCRETE

Refractory Castables are poured and cast like structural Concrete, and being readily available are finding many applications, particularly for preparation of special shapes at site.

	HOW SUPPLIED	REFRACTORINESS	TYPE OF SETTING	THERMAL HARDENING TEMPERATURE	MAXIMUM TEMPERATURE OF USE	lbs./Cu. Ft.
Stein Refractory Concrete	Dry	1420°C	Hydraulic	1200°C	1350°C	120
Stein Super Refractory Concrete No. 16	Dry	+1750°C	Hydraulic	1200°C	1600°C	160
No. 17	Dry	+1750°C	Hydraulic	1200°C	1700°C	160
No. 18	Dry	+1750°C	Hydraulic	1200°C	1800°C	160
Stein Chrome Concrete	Dry	+1750°C	Hydraulic	1200°C	1500°C	180

Use our advisory service based on 70 years experience in the refractory field—it can improve your furnace efficiency. For further information write, phone or call:

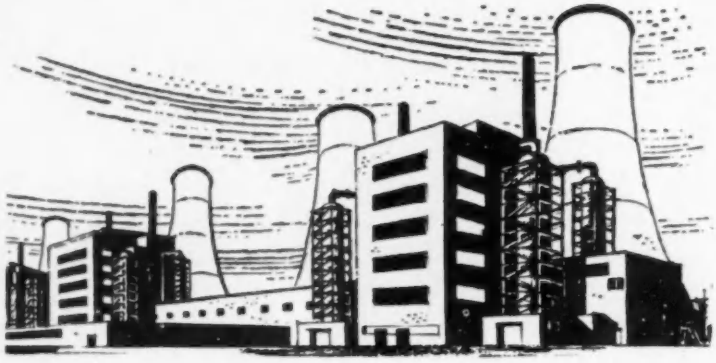
JOHN G. STEIN & CO. LTD. Bonnybridge, Scotland

TEL: BANKNOCK 255 (4 LINES)

We are proud to have been entrusted with large contracts for the thermal insulation of

CHAPELCROSS

NUCLEAR POWER STATION



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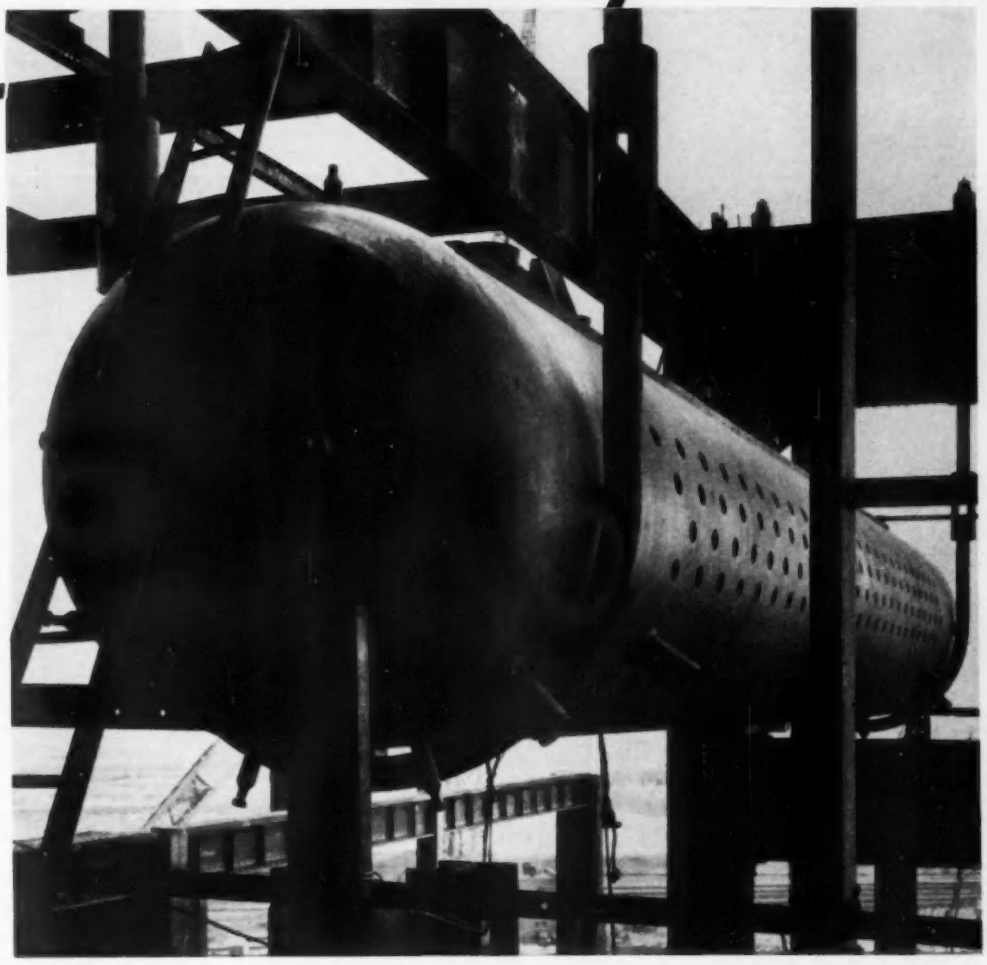

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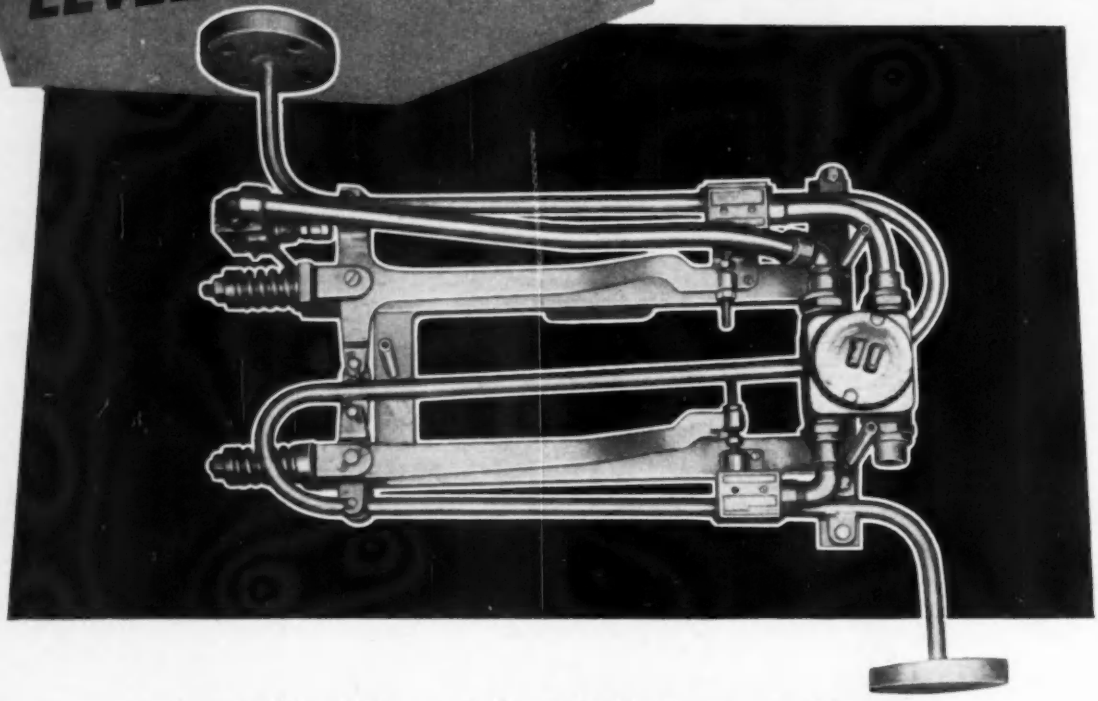

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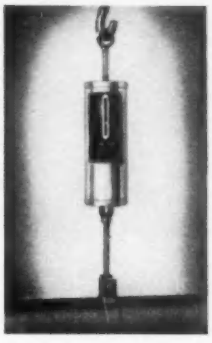

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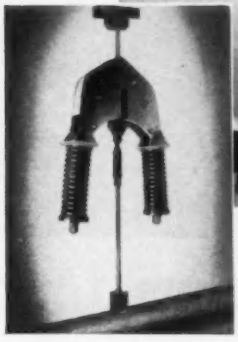

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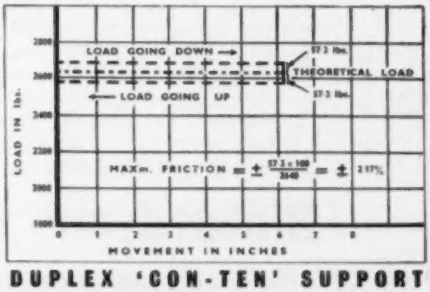

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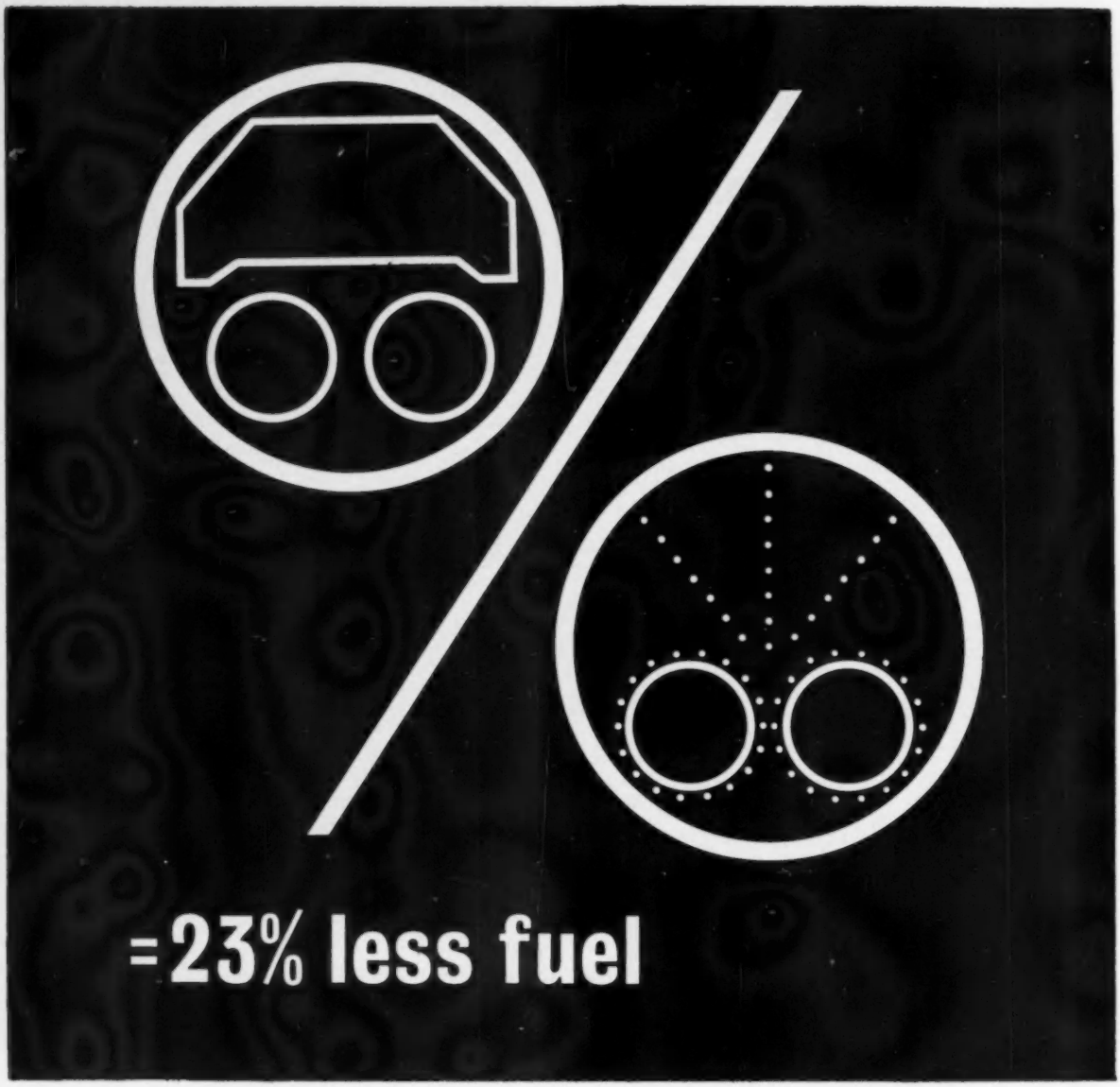

A recent survey has shown that the average efficiency of Lancashire boilers used in this country is less than 65 per cent. On the other hand the efficiency of Richardsons Westgarth Economic Boiler plant is usually between 80 and 85 per cent. For the same amount of steam therefore you pay between 18 per cent and 23 per cent less for fuel, a point worth bearing in mind when installing new boiler plant.

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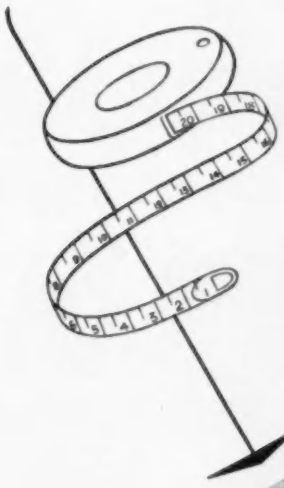

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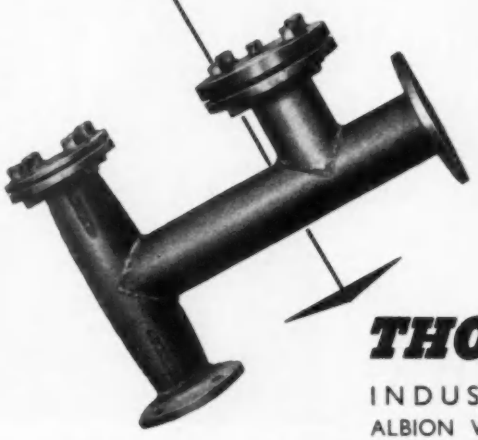

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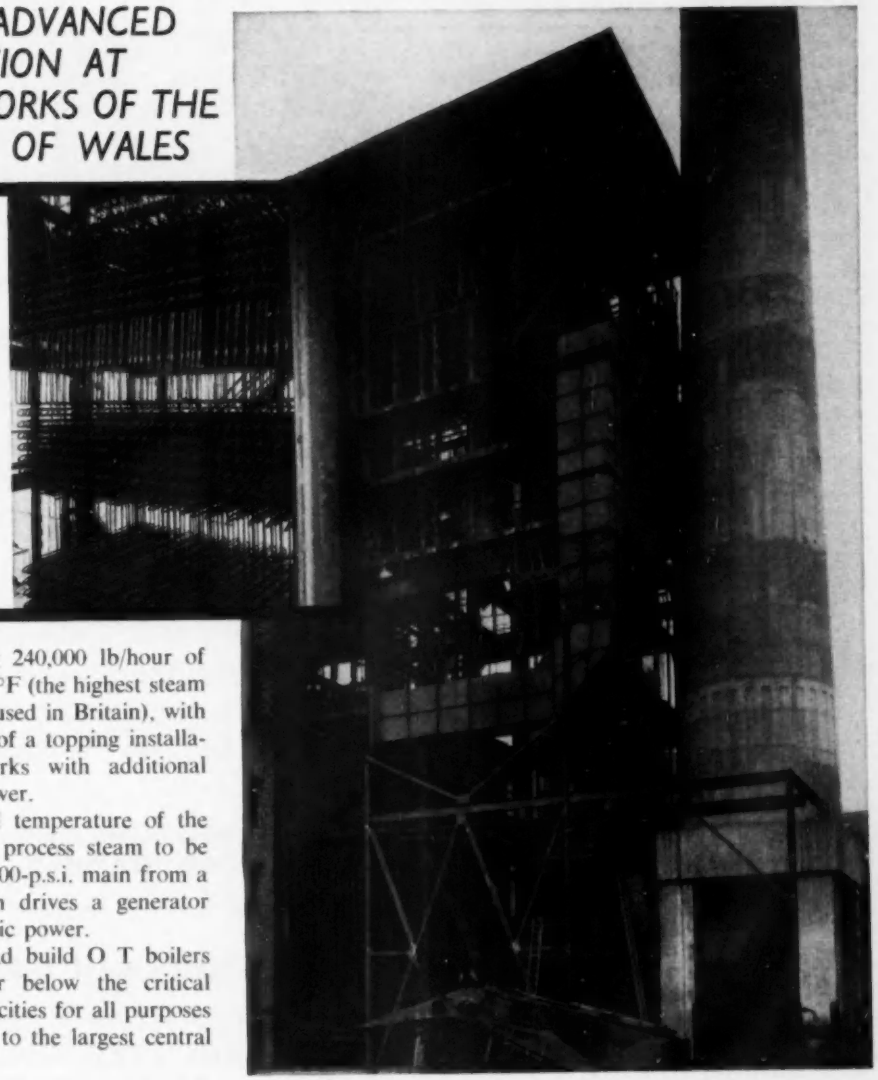

Main illustration. *A general view of the boiler under construction. This is an outside job, but the operating front is housed in the turbine building.*

Inset illustration. *This close-up of the top three banks of the evaporator, taken before the chamber walls were fitted, shows the type of evaporator surface.*

This O T boiler, generating 240,000 lb/hour of steam at 3300 p.s.i. and 1060°F (the highest steam conditions yet commercially used in Britain), with reheat to 840°F, forms part of a topping installation to supply the steelworks with additional process steam and electric power.

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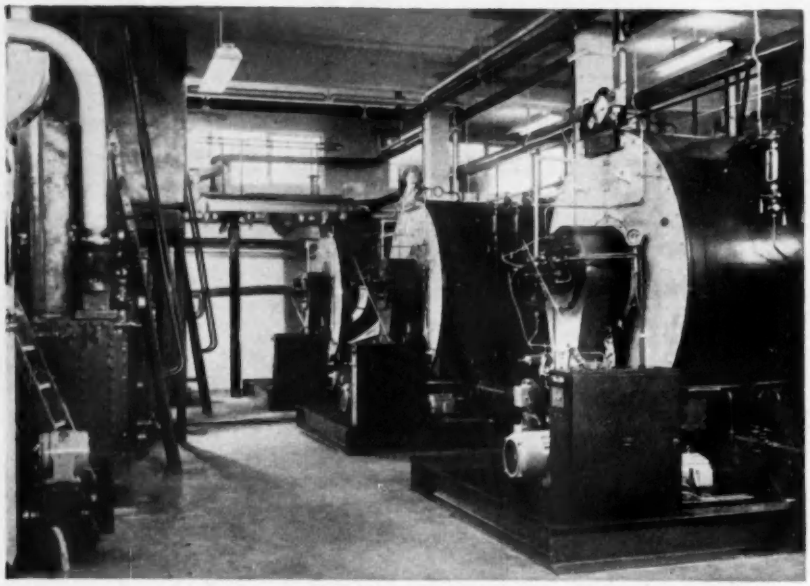

3 *STEAMBLOC MODEL 400 UNITS being part of a Steambloc Packaged Boiler installation supplied to the United Kingdom Atomic Energy Authority.*

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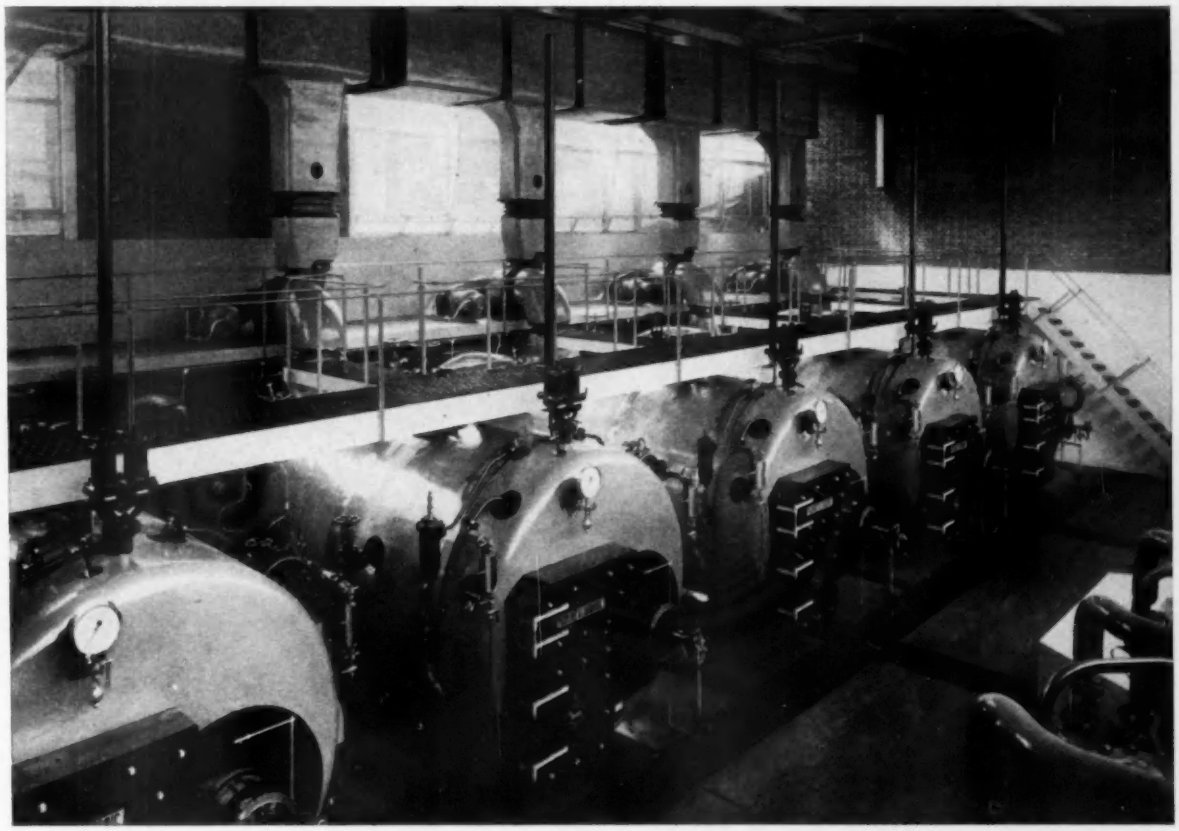

Photograph by courtesy of Davey, Paxman & Co. Ltd.

Changing conditions in Industry today call for new materials and new techniques in the field of insulation.

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The photograph shows the insulation of five Davey, Paxman Ultranomic boilers at the Bristol Aeroplane Co. Ltd.

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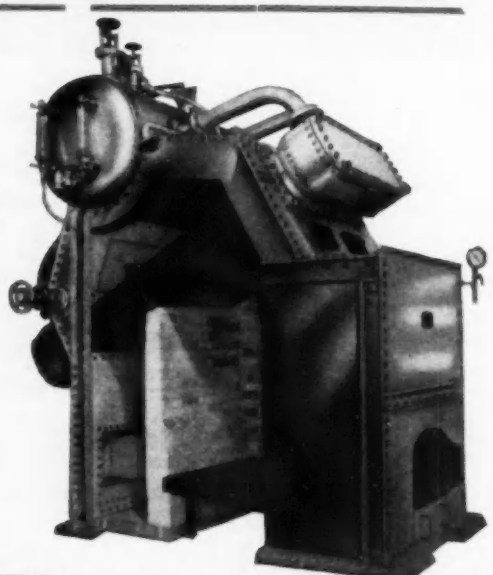

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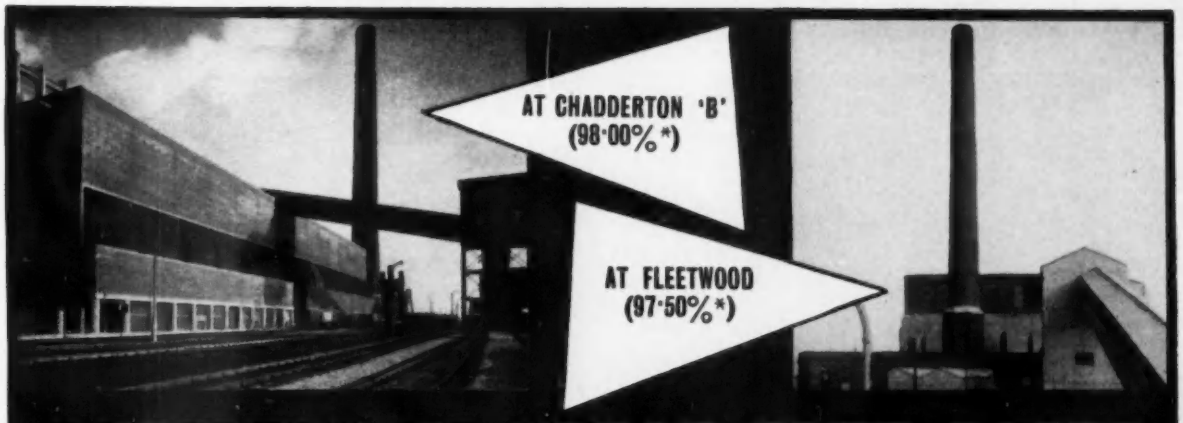

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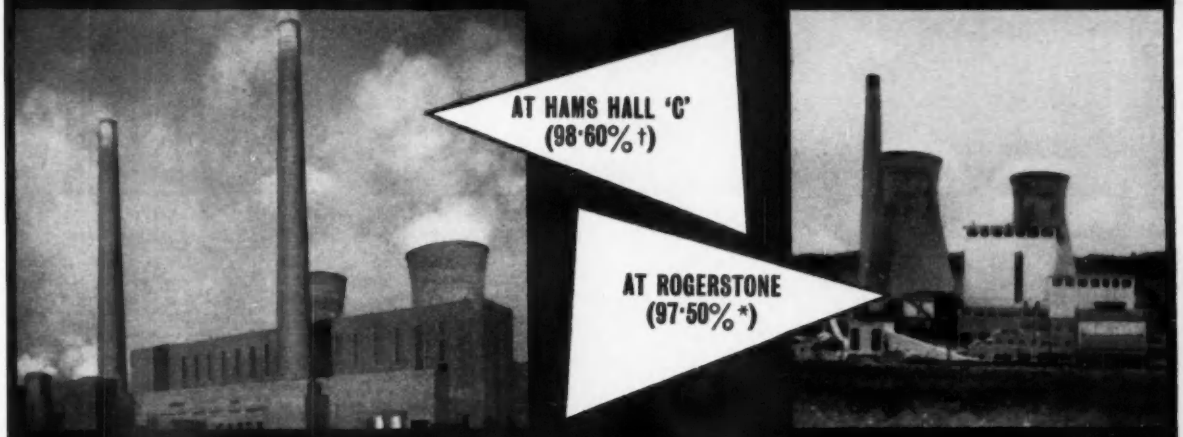

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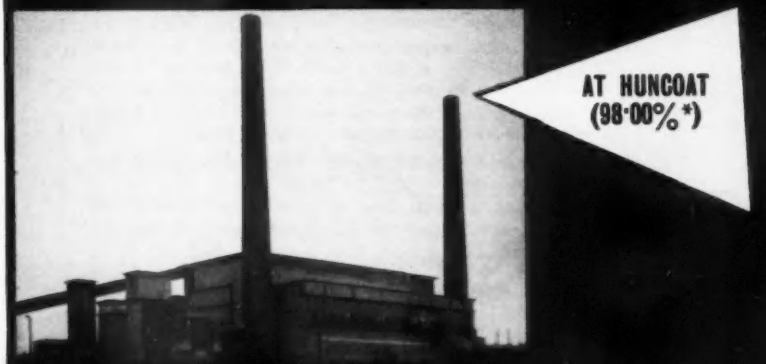

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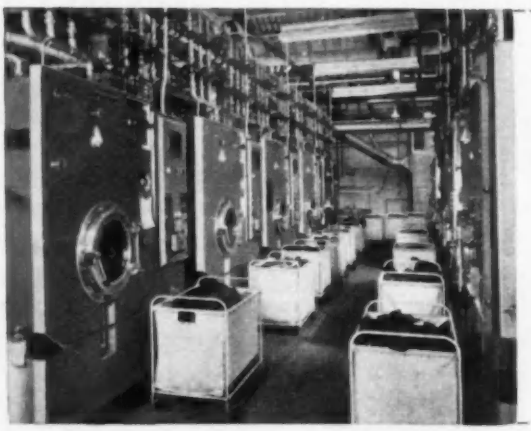

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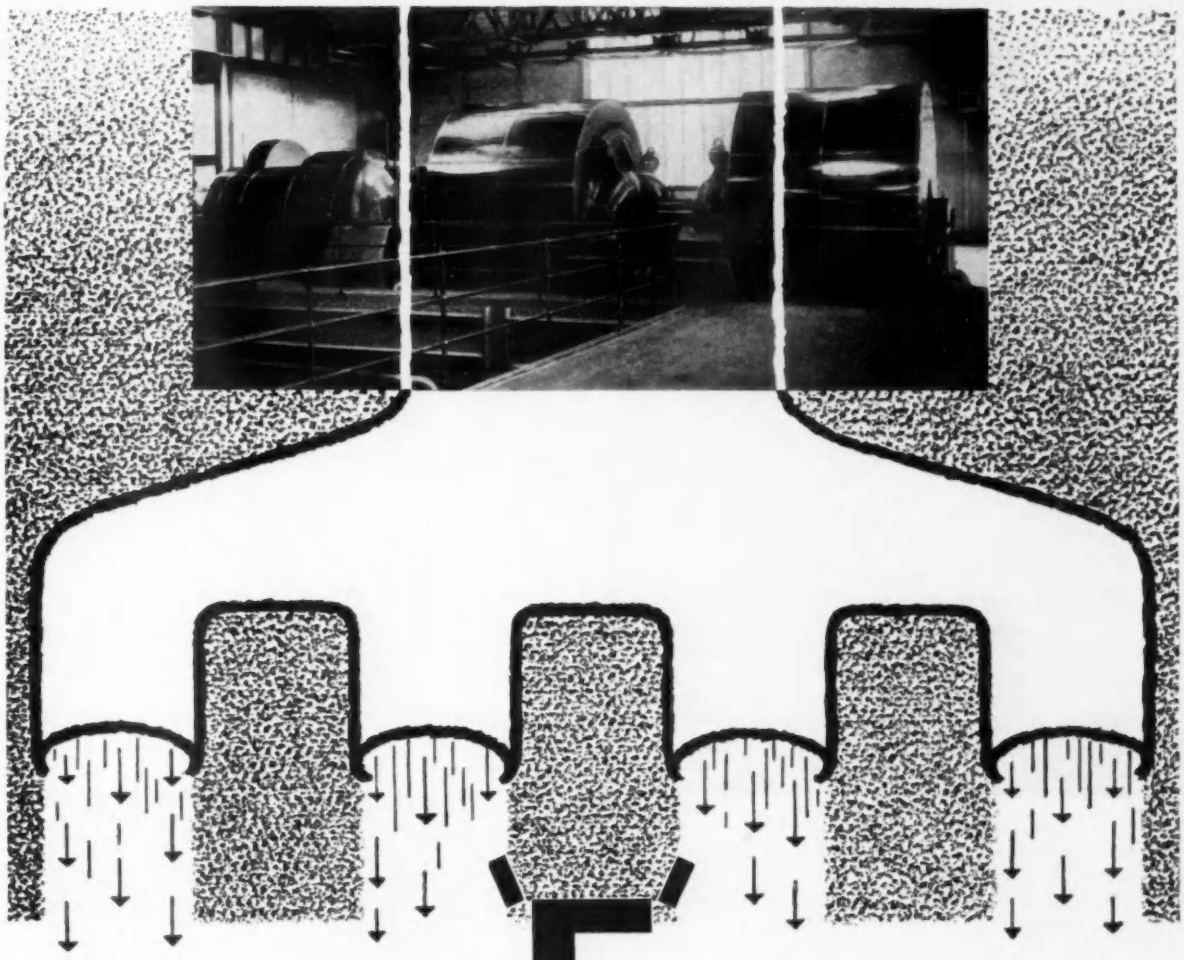

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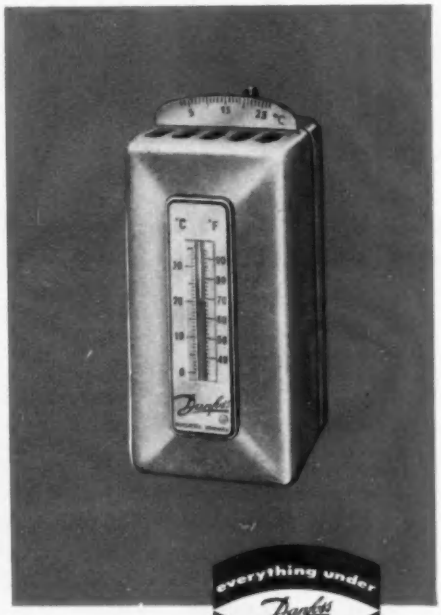

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Type ST-V closes at rising temperatures. The contacts are made of pure silver and the electrical breaking capacity is:—
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Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

JUNE 1959

VOLUME 74. No. 6

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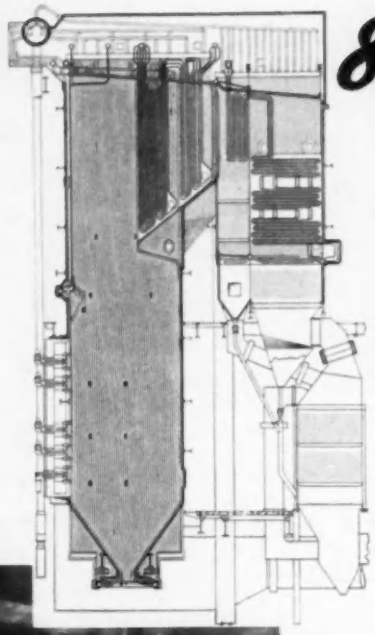
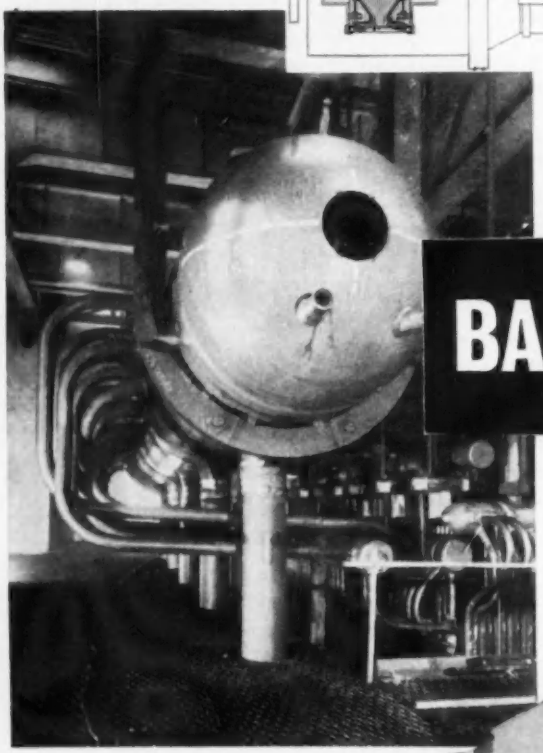


(Right) Boiler arrangement. (Below) Drum-level view at an advanced stage of erection. The fusion-welded drum weighs over a hundred tons.



Largest-capacity boiler unit operating in Great Britain is the first of the four 860,000 lb./hr. (120 MW) Babcock boilers at Blyth A power station (N.E. Division, C.E.G.B.). These are pulverized-coal-fired Radiant-type units for steam conditions of 1600 lb./sq.in. S.O.P., 1010°F, with reheat to 1005°F.

Blyth 'A' will undoubtedly rank among the highest efficiency installations in the country; the station returning the highest overall efficiency at present being Castle Donington, which also is equipped entirely with Babcock boiler plant.

Modern dust-handling at Blyth.

The whole of the dust from precipitator hoppers and other collecting points will be handled by the Babcock low-pressure pneumatic system, using Air-Slides and Fuller-Kinyon pumps, delivering to storage bunkers and thence to mixer-conveyors, for barge-disposal. This will be the largest of many installations using this outstandingly effective system.

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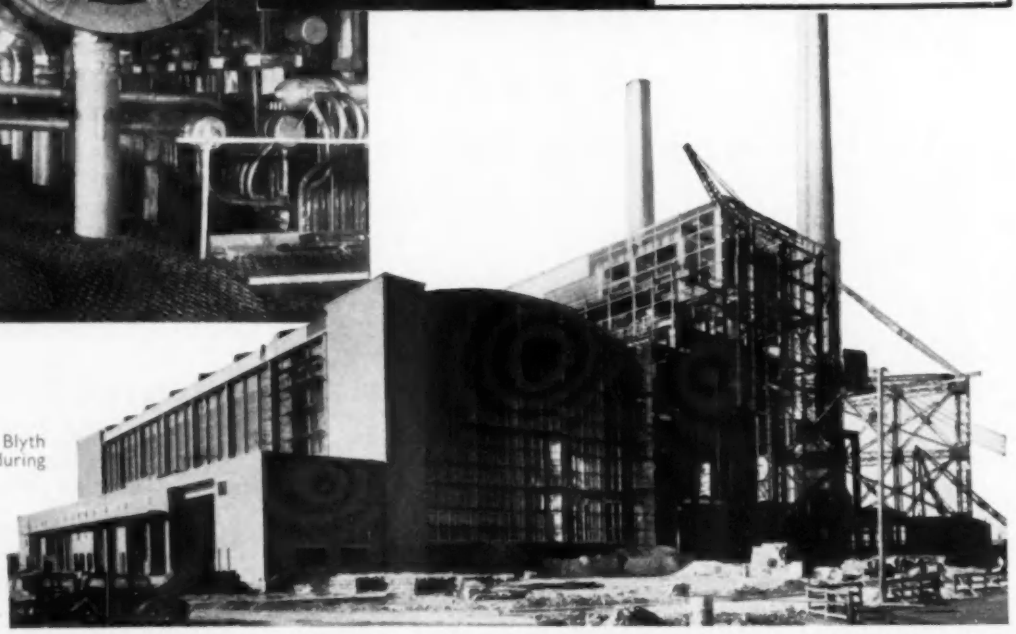
BABCOCK at BLYTH



General view of Blyth 'A' power station during construction.

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VOLUME 74 No. 6

IMPROVED OPERATIONAL EFFICIENCY

A STATEMENT just issued by the Central Electricity Generating Board shows that the overall average thermal efficiency achieved during 1958 at the power stations operated by the Board was 25.99 per cent. as compared with 25.38 per cent. for the previous year, and with 24.70 per cent. for 1957. More than one-third of the 84.670 million units supplied from these stations during last year was provided by the 20 most efficient stations—these having an average efficiency of 30.23 per cent., as compared with an average of 29.45 per cent. for the 20 most efficient stations last year. The list of the most efficient stations, together with their individual efficiency percentages, is published elsewhere in this issue. These increases in individual station and average efficiency percentages may not appear to be large, but they are, none the less, both important and encouraging, particularly as improved thermal efficiency has, during the year, resulted in a reduction in fuel cost equivalent to more than £4½ million. The improvement is, of course, due mainly to improved design and increased availability of modern pulverised-fuel-fired boilers, coupled with still further progress in turbine design, and the adaptation of the unit system involving one boiler supplying one turbo-alternator set. Although terminal steam temperatures with plant at present in operation are limited to around 1,050 deg. F., with or without reheat, new plant now under construction is designed for terminal steam pressures of 1,500 lb./sq. in. and beyond—viz., 2,350 lb./sq. in. at High Marnham, Blyth "B," and West Thurrock, and 2,400 lb./sq. in. at Thorpe Marsh—temperatures in each case being 1,050 deg. F. The capacities of new generating sets being installed are 120, 200, 275, 300 and 550-MW respectively. At the beginning of this year, the total generating capacity installed in the C.E.G.B. power stations was over 25,000-MW but the demand for power is such that, by 1965, the total is planned to reach approximately 40,000-MW.

The successful operation of Calder Hall during the past two-and-a-half years, and the recent opening of Chapelcross nuclear power plant of the United Kingdom Atomic Energy Authority have placed this country well ahead of the rest of the world in the commercial generation of nuclear power. This position may well be maintained in view of the good constructional progress being made with the C.E.G.B. nuclear power stations at Bradwell, Berkeley and Hinkley Point.

It has been envisaged that by 1965 some 1,500-MW to 2,000-MW of nuclear power plant will be in operation. But all this activity in nuclear power plant construction does not mean that the development of conventional thermal plant will stop. Just recently the board announced its intention to construct Drakelow "C" power station which will have an installed generating capacity of 1,500-MW, and will be located near the Drakelow "A" and "B" stations on the fringe of the East Midlands coalfield, which is a major source of the low-grade coals used in electricity generating stations. The actual steam conditions and size of the boilers and generating sets to be installed have not yet been determined.

Both the electricity supply authorities and the manufacturers of boilers and generating plant are carrying out far-reaching programmes of research and development in the endeavour to increase thermal efficiency of operation. This is obviously necessary, because, despite the magnitude of the nuclear power programme, the larger part of this country's electrical power requirements will continue to be provided by coal or oil-fired generating plant for many years. The country needs not only more power, but more efficiently generated and cheaper power. With this end in view, steam pressures and temperatures are being raised still more, and the larger unit sets are being installed.

At the British Electrical Power Convention last year, Sir Christopher Hinton mentioned that nuclear power can only compete successfully with conventional power if flexibility of operation can be built into the nuclear power stations, and if their capital cost per megawatt can be considerably reduced by 1966. If development work on nuclear reactors and their associated equipment to reduce the capital costs of nuclear power plants is not complete and well-established by that time, then there will be two alternatives: the first, to go ahead with nuclear power producing electricity more expensively than by conventional means; the second, to revert for some time to conventional power stations, totalling about 2,000-MW annually, leaving only 300-MW to 400-MW of nuclear power to be provided annually to match the probable growth in base load.

Points and Pointers

E.R.A. ANNUAL LUNCHEON The annual luncheon of the British Electrical and Allied Industries Research Association (E.R.A.) was held recently at the Savoy Hotel, London. After the loyal toast had been proposed by the President, Sir Henry Self, a toast to the E.R.A. was proposed by Sir George Thomson, who congratulated the Association on the excellence of the work it had done over a wide range of electrical subjects. There was a most useful interchange of knowledge and information. The rapid advances which were being made in research demanded the maximum co-operation between the people who did the research and those who used the results of it. In the research field, published work seemed to double in quantity every 10 years. The growth of knowledge as exemplified by the engineering journals was a real problem and it resulted in most people reading too much. There was no single remedy, but the E.R.A. abstracts were a great help. Many important advances were the results of the linking together of work in different fields. For example, physiology had been completely revolutionised by electronics. Sir George said that the work of the "populariser," who explained what happened in one field so that it was understandable to workers in other spheres, was becoming as important as that of the people who did the research itself. He would like to see the Royal Society elect one "populariser" each year. The response was made by Sir Henry Self, who said that the twentieth century was seeing the coming of age of the scientific revolution. In the electrical industry they looked for inspiration to the E.R.A., which focused all the different strands of effort in the many branches of electrical research. During the past 100 years, extraordinary progress had been made, and the scientist must help the lay mind to understand what he was talking about. Referring to finance, Sir Henry said that if industry wanted the job done, it must pay for it, but it was essential for small firms to help to sponsor the research which they could not possibly finance or undertake on their own. Mr. O. W. Humphreys, chairman of the Council of the E.R.A., then proposed a toast to the president, who, he said, believed wholeheartedly in co-operative research. The E.R.A. was created many years ago, but its potentialities had not always been fully appreciated. Knowledge and resources must be pooled if the maximum benefits were to be obtained. Mr. Humphreys referred to the need for a thorough reorganisation of the structure of the E.R.A. to find the proper level in the programme. They were now nearly at the stage when some firm proposals could be announced.

B.C.U.R.A. COMES OF AGE Elsewhere in this issue we publish some notes on the celebrations held at the headquarters at Leatherhead, of the British Coal Utilisation Research Association to mark the 21st anniversary of the establishment of the Association. During the 21 years of its existence, B.C.U.R.A. has contributed a great deal towards the better use of coal and its derivatives in both the industrial and domestic fields. In all the changing coal supply conditions since 1938, the Association had adapted itself to the needs of the times. Current research at B.C.U.R.A. is being directed mainly toward improving and devising appliances suitable for burning small coal; developing methods for the automatic control of combustion; reducing atmospheric pollution from coal burning appliances; and developing new products from coal. Of its total staff of some 300, 80 are graduates, and a similar number, research assistants, representative of most of the recognised fields of physical science, from mathematics through the several branches of chemistry and physics to full-scale engineering. The Association is supported by the National Coal Board, the Electricity Council, the Gas Council and the British Transport Commission, and about 150 other members—both individual firms and trade associations:—for example, the Chamber of Coal Traders, the Water-Tube Boilermakers' Association, the Association of Shell Boiler Makers, and the British Ironfounders' Association. By linking the four nationalised industries with private industrial appliance makers, coal distributors and consumers, the Association occupies a focal position in fuel utilisation and research.

BRITISH OIL BURNER MANUFACTURERS' ASSOCIATION The annual general meeting of the British Oil Burner Manufacturers' Association was held in London, on Wednesday, May 6th, when Mr. J. D. FitzGerald, managing director, Combustions Limited, was elected President of the Association. Other elections were:—Vice Presidents: Mr. W. C. J. Mollison (Todd Oil Burners Limited) and Mr. A. M. Wood (The Wallsend Slipway & Engineering Co. Ltd.). Mr. R. H. G. Sutton [Urquhart's (1926) Limited], Mr. H. F. C. Newsom (Nu-Way Heating Plants Limited) and Mr. P. A. Martin (Quiet May Oil Burner Limited) were re-elected to the Council, and the following additional Council Members were also elected: Mr. J. R. Ball (Watts Automatic Boilers), Mr. E. G. Brooks (Thomas Potterton Limited), Mr. R. L. Cox (G. N. Haden & Sons Ltd.), Mr. K. R. Green (Stonebridge Electrical Co. Ltd.), Mr. W. G. Myatt (Brockhouse Heater Co. Ltd.), Mr. R. W. Towers (Rheostatic Co. Ltd.) and Mr. A. K. Waugh (A. K. Waugh Limited). At the luncheon which followed this meeting, Mr. A. W. Hubbard, Immediate Past President, proposed the toast of "The Guests of the Association," coupled with the name of the President of the Institute of Fuel. Mr. Hubbard mentioned that for the first time at this function, the Association had the pleasure of welcoming the presidents of the three technical institutions with whom they work in close collaboration, namely, Mr. C. M. Vignoles, C.B.E., President of the Institute of Petroleum, Mr. H. C. Jamieson, President of the Institution of Heating and Ventilating Engineers, and Mr. T. C. Bailey, President of the Institute of Fuel. In replying to the toast, Mr. Bailey referred to the close co-operation between the Institute of Fuel and the Association and also

to the fact that he, with 40 years' service with Shell-Mex & B.P. Limited, had worked in co-operation with people who were now member firms of the Association in many developments of oil-firing, and had seen the oil burning industry grow from a few pioneer firms to its present strength with its own representative association of approximately 180 full members and associate members. The toast of "The President" was proposed by Mr. A. M. Wood, to which Mr. FitzGerald replied.

IRON AND STEEL INSTITUTE The ninetieth annual meeting of the Iron and Steel Institute was held in London on Wednesday and Thursday, May 6th and 7th. The annual report of the council, which was submitted to the meeting, showed that at the end of 1958 the total membership of the Institute was 5,098, the highest total in its history. The retiring President, Mr. C. R. Wheeler, presented the Institute's annual awards, as follows: Bessemer gold medal to Professor Bo Kalling, in recognition of his distinguished contributions to the physical chemistry of steelmaking; Sir Robert Hadfield medal to Mr. Albert Jackson for his notable contributions to metallurgy and metallurgical education, including particularly the development of the "Ajax," oxygen process; Andrew Carnegie silver medal to Dr. P. Vasudevan, for a paper of "The Kinetics of Bainite Formation in a Plain Carbon Steel," and the Williams prize to Mr. H. C. Child for a paper on "Vacuum Melting of Steels." Mr. W. Barr was installed as President in succession to Mr. Wheeler, and delivered an address, which dealt with progress and development in the application of steel plate. There were three sessions for the discussion of papers, the subjects covered being "Recent Applications of Oxygen to Steelmaking," "The Mechanism of Bainite Formation," and "Hydrogen in Steel." The Institute's annual dinner was held at Grosvenor House on Wednesday evening, May 6th, with the President, Mr. W. Barr, in the chair. The principal guest was Mr. J. S. Maclay, Secretary of State for Scotland, who proposed the toast of "The Iron and Steel Institute and Industry."

THE BRITISH ENGINEERS' ASSOCIATION The British Engineers' Association, sponsors of the Engineering, Marine, Welding and Nuclear Energy Exhibition, held at Olympia, during April, have been encouraged by the record attendance of visitors from no less than 84 different countries, to announce plans for a new and imaginative approach to certain key overseas markets. The first target will be Canada. In a recent speech, Sir Edward Thompson, M.A., J.P., President of the British Engineers' Association and Honorary President of the Engineering, Marine, Welding and Nuclear Energy Exhibition, said: "the exhibition is only one of our contributions to Britain's overall export drive. Many people know that the British Engineers' Association is at present planning a Trans-Canada mobile exhibition of engineering equipment which will metaphorically take our products to the door-steps of those very discriminating purchasers—the Canadians. Canada has been selected because her rapid growth is phenomenal. In the last 10 years her population has gone up by 25 per cent., while the nett *per capita* income has gone up by 50 per cent." The plan to which Sir Edward referred provides for a train of up to 60 specially-designed show cars to carry a comprehensive exhibition of U.K. engineering products from coast to coast across Canada during May and June of 1960. Starting at Vancouver, and mounting exhibitions at not less than six of Canada's main industrial centres on the way, the journey will take approximately two months and is expected to cost about half a million pounds. Calgary, Edmonton, Winnipeg, Toronto, Montreal, Ottawa and Halifax are among centres likely to be visited. Mr. A. W. Berry, director of the British Engineers' Association, has described the new project as a bold and constructive endeavour to add momentum to steadily improving trade relations between Canada and the U.K. It would be an undertaking of national importance on both sides of the Atlantic, and it had already received the encouragement of Lord Rootes, Chairman of the Dollar Exports Council. It would do much to offset the criticism frequently levelled that Canadians are expected to travel to the U.K. to discover for themselves what equipment is available to them. "Space on the exhibition train" will necessarily be limited, but even so, many of the larger engineering combines have already shown a keen interest in the plan.

THE INSTITUTION OF PLANT ENGINEERS The twelfth annual conference of The Institution of Plant Engineers was held at Harrogate from May 6th-8th, and was attended by about 300 members and guests. More than 100 firms took advantage of the invitation of the President and Council of the Institution to nominate a representative to attend the Conference. During the evening of May 6th, a civic reception was held by the Mayor and Mayoress of Harrogate. On the morning of May 7th, Mr. K. F. Dormer was installed as the thirteenth President of the Institution. In his Presidential address, Mr. Dormer said that he was particularly conscious of the honour of becoming President, when he reflected that he had, during his membership, seen the Institution grow from a modest body of less than 250 members in 1946, to an established professional Institution with, at the present time, more than 4,000 members. Mr. Dormer remarked that they could, therefore, look back over the preceding 12 years with considerable satisfaction at the Institution's achievements, much of the credit for which must go to the 12 past Presidents whose foresight, drive and initiative, have set a standard which he would use every endeavour to maintain. Continuing, Mr. Dormer said the plant engineer must be prepared to accept—and indeed, press for—changes in methods, machinery and practices to enable his concern to play a greater part in helping this country to compete with foreign industry. If his contribution is to be effective, and its potential importance is obvious, he must be capable of expansive thinking, he must develop a high degree of cost consciousness and appreciate the responsibilities of management, for there is no doubt at all that his role in the management team is going to be increasingly important in the future. How best can an institution help him? There is a vast fund of engineering knowledge and experience in our membership and it is at branch and institution meetings that this becomes available and is readily given. What better facilities can there be for the dissemination of technical information than those provided by an institution such as ours? And surely among the best facilities of all are those provided by a conference such as this.

Chapelcross Nuclear Power Station

IN the May issue of this journal we included some notes and illustrations concerning Chapelcross Nuclear Power Station, which was officially opened on Saturday, May 2nd, 1959. These notes dealt with the station in general, the steam-raising plant, generating plant and other auxiliary equipment. In this issue we publish some constructional details and further notes on the reactors, and equipment associated therewith.

The subsoil at the site consists of boulder clay overlying round sandstone rock at depths ranging from 25-ft. to 60-ft. To ensure a sound foundation, the biological shields of the reactors, which are concrete structures with 7-ft. thick walls, 90-ft. high and 46-ft. across the inside, were built directly on to the rock, as the raft-type of foundations as used at Calder Hall would not be suitable for the type of ground met with at Chapelcross. The foundations and biological shield were constructed from concrete to meet the same rigid specification as called for at Calder Hall, but using 75 per cent. gravel from local pits with 25 per cent. whinstone. A crushing strength of 3,000 lb./sq. in. at 28 days, and a dry density of 150 lb./cu. ft. as required by specification was readily obtained. The maximum amount of concrete placed in any one week was 3,262 cu. yd., and over the peak period of construction the amount of concrete placed per week averaged approximately 2,000 cu. yd.

The Mitchell Construction Co. Ltd., Peterborough, are the main civil engineering contractors at Chapelcross; their work included the construction of the concrete structures for the four reactors, the cooling towers and the turbine house. In addition, the company completed preliminary site clearance, several miles of access roads, the various drainage systems, the circulating-water culverts of reinforced-concrete, and the constructional work of the fuel element cooling ponds.

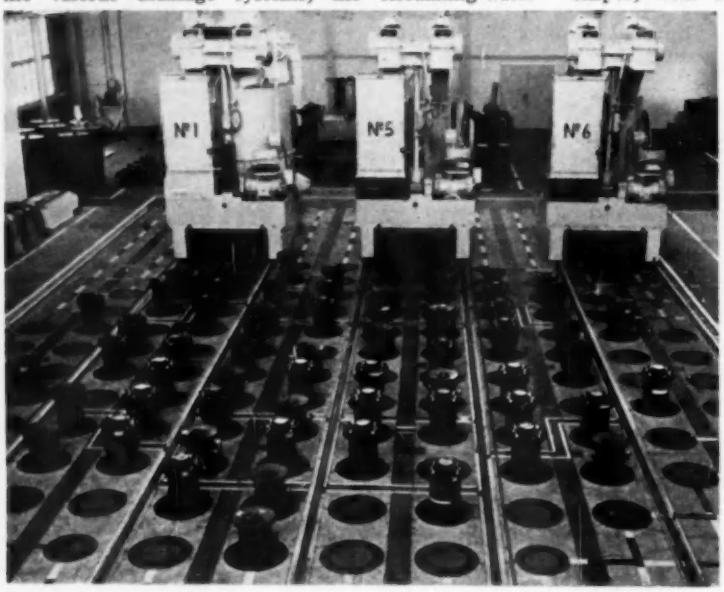
Pressure vessel

With the biological shield side walls complete, the 6-in. thick steel thermal shield was made up of 653 plates of size 8-ft. × 3-ft. installed, and the final assembly of the pressure vessel inside was then begun. When the pressure vessel was finished, the biological shield was closed by pouring the 8-ft. thick reinforced-concrete pile roof on to permanent steel shuttering set above the top of the thermal shield, great care being taken to ensure that the under-side of the concrete was flat when set. The process of stacking the graphite core then commenced.

The installation of the thermal shield, the graphite base plates and graphite core, and also the charge pans, the burst slug detection gear and the charge-tube cooling equipment was all carried out by Thos. W. Ward Limited, Sheffield, who have had considerable experience in this class of work at the Springfields, Sellafield, Capenhurst and Dounreay establishments of the United Kingdom Atomic Energy Authority.

The base-plate on which the graphite core rests consists of 69 steel plates each 4-in. thick and weighing approximately 1-ton, the top surface of each plate being machined to provide an accurately level surface. The actual installation of these base-plates called for the greatest accuracy. In the levelling of the plates, which was carried out with the aid of water-micrometers, a tolerance of only plus 0.01 of an inch and minus nil was permitted. The graphite structure is 27-ft. high by 36-ft. diam. and consists of 58,000 graphite bricks and tiles of various shapes, with about 1,800 vertical channels running through it. Some 1,696 of these channels contain fuel elements, each 40-in. long, and stacked one above the other six high. The other channels accommodate the control rods and instruments. The uranium rods are about 1.15-in. diam.; and are sealed in magnesium alloy cans with spiral fins to assist in dissipating the heat. The total weight of the reactor structure is approximately 1,050-tons.

The first layer of graphite is laid on ball bearings and held in position by jacks which fit into the base-plates. The graphite is jacked within a strict tolerance to pre-set straight edges. These layers and all other layers are tied together by restraints which are drawn up to the tightness required by 12 sets of spanners all operating simultaneously. The strain of the ties is established by measuring the stress on



View on charge floor of No. 1 reactor showing the fuel element charge and discharge machines

the outer sleeve of the tie bars. The bricks, tiles and sleeves were all brought up from the graphite store in wheeled skips and carried in specially-equipped clean vans in the sequence in which they were to be laid. They were then inspected for condition, and jig-tested for tolerance, prior to being transferred into the vessel and taken straight out of the skips, and laid, without any stock pile, in the vessel. The work had to be carried out under the most stringent clean conditions and every man engaged on the work had to make a complete change of clothing on entering the vessel.

(Left). Some of the 1,696 stainless steel tubes for gas sampling in the burst slug detection gear. About 40 miles of ¼-in. dia. tubing is used in each reactor.

(Below). Installing graphite base-plate comprising sixty-nine 4-in. thick steel plates. " Water micrometers " are used to achieve the degree of accuracy of levelling to a tolerance of +0.010-nil.

A recent design modification introduced on Chapelcross reactors Nos. 2, 3 and 4 concerns the introduction of removable graphite sleeves into all fuel channels to provide a solution to the stored energy problems associated with irradiation damage of the graphite moderator —the " Wigner effect." In 1942, E. Wigner predicted that moderator atoms could be displaced by fast neutrons. These displacements could be permanent in the absence of annealing, with corresponding changes in thermal and electrical conductivity, electrical constants, thermal expansion, etc. Changes in physical dimensions are catered for by utilising the differing growth rates along the various axes, by permitting adequate growth clearance where necessary. In the event of graphite with a stored energy content being heated sufficiently above the normal temperature at which irradiation occurs, release of the stored energy will be initiated. Moreover, after sufficiently long irradiation, it is possible to have a stored energy content per unit mass greater than the specific heat value of the graphite. Accordingly, a solution has been found in the provisions of removable sleeves which are so designed that a small gap is left between them and the bulk of the graphite. This gap, which becomes filled with the coolant gas, acts as a thermal insulation barrier and ensures that the bulk graphite temperature is raised above its normal value thus ensuring some measure of self-annealing.

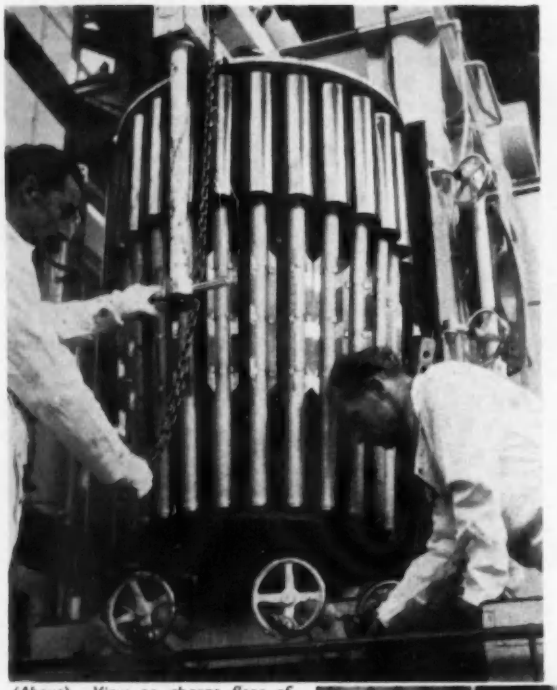
(Below). Charge tube cooling sleeves, the installation of which was carried out by Thos. W. Ward Limited.

While this solution has been adopted for Chapelcross reactors Nos. 2, 3 and 4, No. 1 reactor will use an alternative method whereby " Magnox " sleeves are lowered into unmodified channels, if this should be necessary in the future. This operation, however, reduces reactivity and channel flows, and thus reduces power, and adds appreciably to outage times. The Chapelcross reactors, like

those at Calder, can only be refuelled when they are shut-down and when the coolant gas pressure is at near atmospheric.

Reactor control

The reactor is controlled mainly by the quantity of CO_2 being circulated, and secondly by the movement of the fuel rods into the core. These rods absorb neutrons and control the rate at which fission takes place. The control rod system and mechanism which was supplied by Metropolitan-Vickers Electrical Co. Ltd., and which provides "failure-to-safety" under all conditions, was described in the May issue of this journal. Occasionally one of the fuel element cans develops a slight crack or pinhole and some of the gaseous fission products then begin to escape. As these are radioactive, the particular gas sample from that channel will show a small increase in activity and give warning of the leak. The operator is thus able to identify the channel containing the faulty fuel can, and that stack of fuel elements is then replaced.



(Above). View on charge floor of No. 1 reactor showing a fuel basket holding 24 elements being loaded into a charge machine.

(Right). Pye closed-circuit television equipment used for examination of fuel channels.

The burst slug detection gear involved the provision by Thos. W. Ward Limited of approximately 44 miles of ½-in. bore stainless-steel tubing laid inside and outside the vessels of each reactor. There are the 1,696 separate pipe channels, each channel usually consisting of seven pipes which are joined by a coupling brazed by Delapena Induction Heating Equipment, the total number of brazed joints being in the region of 12,000. The pipes are pre-fabricated at Calder Works, then cleaned inside and out at the degreasing plant at site with trichlorethylene, and transported in special containers to the reactors.

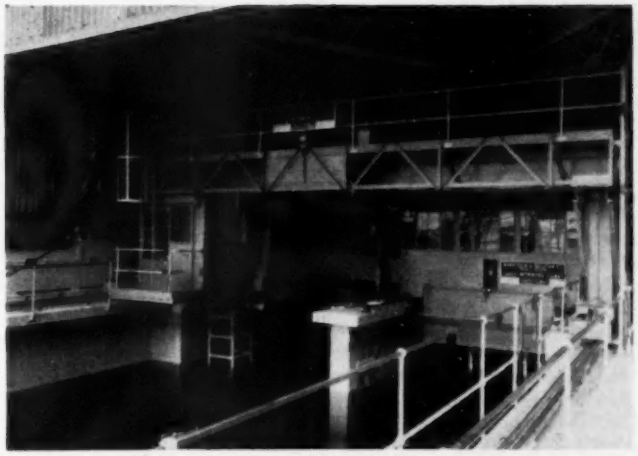
The Distillers Co. Ltd. (Chemical Division), which manufactures carbon dioxide, and provides the associated storage equipment, was responsible for the installation of the CO_2 storage plant. Except for the installation at Calder (which was also supplied by The Distillers Co. Ltd.), the Chapelcross plant is stated to be the largest in the country. The main components of the installation are five large storage tanks, complete with refrigeration, insulation and pipework for filling them; and six evaporators which serve to vaporise the liquid CO_2. The storage tanks are each of 20-tons liquid CO_2 capacity, each tank being 6-ft. 6-in. i.d. × 23-ft. long. They are designed for a safe working pressure of 350 lb./sq. in., and were manufactured for The Distillers Co. Ltd. by John Thompson (Wolverhampton) Limited. Insulation of tanks, which was carried out by Dick's Asbestos & Insulating Co. Ltd., London, consists of 9-in. of compressed cork made up in three layers each 3-in. thick, with all joints staggered to provide an effective seal. The cork is then coated with a layer of emulsified bitumen to provide a vapour seal. Finally, the vessel is covered with 20-gauge aluminium cladding supported by hollow-based aluminium bands. Refrigeration of the liquid CO_2 is provided by air-cooled condensing units, one to each tank; this equipment being provided by Metropolitan Refrigeration Limited, who also supplied the gauge panel. The units operate automatically and maintain the pressure in the tanks to within limits 295 to 305 lb./sq. in. The CO_2 evaporators were manufactured by The Distillers Co. Ltd. and are of the jacketed-tube type. Each evaporator consists of eight tubes 2-in. nominal bore and 14-ft. long, with jackets for 30 lb./sq. in. steam welded on.

Storage pond for irradiated fuel elements

In our last issue we made reference to the storage or cooling pond for the irradiated uranium. Such a pond is not required at Calder Hall, because of the close proximity of that plant to the Windscale ponds. Chapelcross is about 75 miles from the Windscale plutonium factory and, like the nuclear power stations now under construction for the C.E.G.B. and S.S.E.B., it requires individual storage ponds. The pond is a reinforced-concrete structure and consists of two rectangular

storage ponds side by side, separated by a common division wall. The water depth is about 18-ft., and each pond holds approximately 400,000 gallons of water. It has sufficient capacity to hold a number of cartridges equivalent to about three reactor charges. Irradiated fuel will be taken to the pond in standard containers holding 24 cartridges, using the rail track on the north side of the reactors, and will be left to decay for some months; it will then be transported by road to the plutonium processing plant at Windscale.

The major functions of the pond are to ensure that transport delays do not affect reactor outage times, and to ease the transport problem so far as vehicles, containers and manpower are concerned. A particular advantage of the storage pond is that it enables use to be made of the natural radioactive decay of the irradiated fuel elements. Any decay eases the shielding problems associated with any subsequent handling operations. After the delay period, it is estimated that it will be possible to transport from Chapelcross to Windscale six times as many cartridges per container as is possible from Calder to Windscale. The Chapelcross containers are about 50 per cent. heavier, but there is, nevertheless, a gain factor of four in the number of cartridges per container, thus diminishing the requirement for containers, vehicles, and man-power. The cooling pond handling equipment which was supplied by Babcock & Wilcox Limited, provides for recovery of the irradiated elements and their disposal into transportation flasks for processing at Windscale Works.



(Right). One of the two spent fuel element cooling ponds showing the 3½-ton Babcock & Wilcox skip-handling crane and the 1,600-lb. Babcock travelling platform servicing the manipulating bays.

A somewhat unusual boiler installation at Chapelcross, comprising three auxiliary vertical boilers supplied by Cochran & Co., Annan, Ltd., was used on the concrete batching plant to provide steam and heating facilities to prevent the concrete around the atomic reactors and other buildings from freezing and powdering in very cold weather. The three boilers are also used for heating the actual reactor buildings until the reactors themselves become critical, as well as to "dry-out" the heat-exchangers. Each Cochran boiler is 10-ft. diam. by 25-ft. high, and has 800 sq. ft. of heating surface, a working pressure of 125 lb./sq. in. and is capable of evaporating 10,800-lb./hr. of steam from cold feed. The boilers are fired by Clyde oil-firing equipment of the low-pressure type. In addition to these applications, the boilers also carry out the functions of supplying steam to the offices and canteens on the site.

A vast amount of insulation work was obviously necessary on an installation of such magnitude. In addition to work carried out by other insulation contractors, over 300,000 sq./ft. of insulation work was carried out by Newalls Insulation Co. Ltd., Washington, Co. Durham. Under contract to Babcock and Wilcox Limited, Newalls carried out the insulation of the 16 steam-raising units and integral piping, and under contract to C. A. Parsons & Co. Ltd., the insulation of turbines, blowers and associated auxiliary equipment and piping. The most important consideration was the emphasis on insulation strength and permanence as no insulation, maintenance, or replacement would be possible while the reactors were in operation. For these reasons Newalls applied extensively their 85 per cent. Magnesia and Newtempheit products—both materials with good structural strength. They were coated after application with Newalls special asbestos cement, to withstand rigorous weather conditions. For the large vessel surfaces and pipe runs, 85 per cent. Magnesia slabs, lags and sections formed the major project material for temperatures up to 625 deg. F. At higher temperatures, "Newtempheit," capable of withstanding temperatures of 1,625 deg. F., was employed principally as a primary layer against the hot surface, with 85 per cent. Magnesia as the outer layer. The latest addition to the Newalls range of materials, Newtherm Calcium Silicate Insulation, which is very light in weight but has considerable strength for use up to 1,400 deg. F., was also applied for the first time on a nuclear power station.

POWER STATION EFFICIENCIES

A reduction in fuel cost, equivalent to just over £4½ million, resulted last year from the improved thermal efficiency of Central Electricity Generating Board power stations. The overall average thermal efficiency during the 12 months of 1958 was 25.99 per cent. as compared with 25.38 per cent. for the previous year. More than one-third of the 84,670 million units supplied from these stations in 1958 was provided by the 20 most efficient stations. These stations had an average efficiency of 30.23 per cent., their individual percentages being:

Station	*C.E.G.B. Division*	*Thermal Efficiency (per cent.)*
Castle Donington ...	East Midlands	32.91
Ferrybridge "B" ...	Yorkshire	31.20
Drakelow	East Midlands	30.84
Willington "A" ...	" "	30.76
Stourport "B" (H.P.)	Midlands	30.31
Meaford "B"	"	30.22
Wakefield "B" ...	Yorkshire	30.12
Stourport "B" (L.P.)	Midlands	30.09
Tilbury	Eastern	30.04
Rogerstone	South Wales	30.03
Marchwood	Southern	30.02
Stella South	North Eastern	29.99
Portishead "B" ...	South Western	29.84
Littlebrook "B" ...	South Eastern	29.73
Hams Hall "C" ...	Midlands	29.52
Plymouth "B" ...	South Western	29.46
South Denes	Eastern	29.40
Stella North	North Eastern	29.30
Dunston "B II" ...	" "	29.08
Ince	North West Merseyside & North Wales	28.89

Boiler Plant for a Commercial Vehicle Assembly Works

As part of a development scheme to meet increased sales requirements, Commer Cars Limited, Luton —the commercial vehicle manufacturing division of The Rootes Group, have segregated the manufacture and assembly of vehicles, by erecting a new assembly plant at Dunstable. This move has enabled the company to re-plan and extend their manufacturing facilities at Luton, where now only machining and component part manufacture takes place—the finished units being conveyed to the Dunstable factory by a shuttle service which is operated by a fleet of the company's articulated diesel trucks.

The Dunstable works, where Commer and Karrier trucks are assembled, has a main covered single-floor area of 300,650 sq. ft.—there being a further 58,000 sq. ft. now in the final stages of construction. Other buildings on the site are canteen, office block, paint store and boiler house.

Space-heating of the works is effected by a high-pressure hot-water system, having a normal circulation of 60,000 gal./hr., at a temperature of 360 deg. F. This feeds some 34 main, three-bank, power-driven blower heaters—each being thermostatically-controlled, and automatically-controlled for regulating the intake of fresh air and re-circulated air. In addition, above each of the 21 electrically-operated major doors around the main assembly building, is fitted a limit-switch-controlled downward-blowing heater of 120,000 B.Th.U./hr. capacity. These heaters operate automatically as the doors are opened, the hot air discharged from above the opening acting as a wall against incoming cold air. Temperatures maintained throughout the building, when the outside temperature is 30 deg. F., are:—main assembly shops, 60 deg. F., offices and canteen, 65 deg. F. A small amount of hot water is also used in the degreasing plant and canteen. Future developments, plans for which are already in hand, will, however, call for an additional estimated load of up to 12-million B.Th.U./hr.

G. N. Haden & Sons Ltd. were responsible for the boiler and heating installation, in co-operation with the consultant, W. T. Mitchell.

The boiler house is situated at the west end of the factory area, and is a steel-framed structure with brick and asbestos cladding, on reinforced-concrete foundations. The enclosed area of 9,750 sq. ft. houses two La Mont Steam Generator Limited boilers, one of 20-million B.Th.U./hr. and the other of 40-million B.Th.U./hr. output, and two Ruston & Hornsby Limited "Thermax" vertical smoke-tube boilers, each of 3,000 lb./hr. capacity. The "Thermax" boilers are provided to supply the necessary steam for heating the heavy fuel-oil burned in the La Mont units. Each boiler is provided with a self-supporting, steel chimney.

The La Mont boilers are designed to operate on a nitrogen-pressurised system at a pressure of 220 lb./sq. in., and are of the forced- and controlled-circulation type. The combustion chamber rear walls are water-cooled, while the floors and front walls are air-cooled. The furnace volumes are 1,425 cu. ft. and 2,350 cu. ft. respectively. Each boiler operates under balanced draught conditions, the fans being made and supplied by Davidson & Co. Ltd. The F.D. fans are designed for a capacity of 25,000 cu. ft./min. for the larger unit and 12,000 cu. ft./min. for the smaller unit and are driven by 10-h.p. motors operating at 1,450 r.p.m. The I.D. fans have a capacity of 12,500 cu. ft./min. for the larger unit and 6,250 cu. ft./min. for the smaller unit and are driven by 7.5-h.p. motors operating at 580 r.p.m. The fan motors were of Crompton Parkinson Limited manufacture.

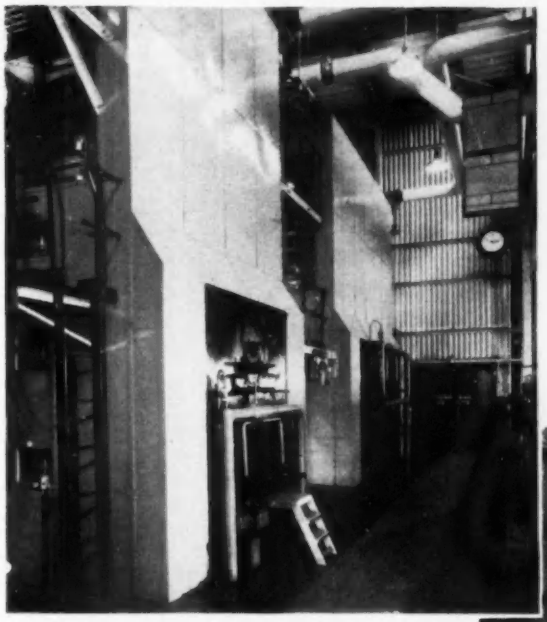
If necessary, these boilers can be fired with pulverised-fuel, but at the present time 3,500 sec. fuel-oil is used. This is delivered by road tanker, and stored in two underground, reinforced-concrete, glass-lined tanks, each of 111,000-gal. capacity. The tanks are steam-heated, and the oil maintained at a temperature of 90 deg. F. Transfer pumps, fitted in tandem, and operating at a speed of 217 r.p.m., against a head of 60-ft. at 4,920 gal./hr. output, deliver the oil to a heating and pumping unit manufactured by Clyde Fuel Systems Limited. The heating and pumping unit delivers the oil, at a pressure of 150 lb./sq. in. and at a temperature of between 250/280 deg. F., into a ring-main which is arranged to serve a total of five burners on the larger and three on the smaller unit. The burners are of the pressure-jet type, supplied by Clyde Fuel Systems Limited, Glasgow, and are manually-operated in accordance with the load demand on the boilers. They are supplied with fuel by any one of three fuel-oil pumps, designed to operate at a speed of 440 r.p.m., with an output of 360 gal./hr. The transfer pumps and the fuel oil pumps were supplied by Plenty & Son Ltd., and are of the positive displacement rotary Universal (infinitely variable capacity) type, capable also of reverse flow without altering the shaft rotation, and fitted with reversible relief valves. Drive is from geared, totally-enclosed, fan-cooled electric motors through a crown-pin-type flexible coupling. All the fuel-oil lines between the transfer pumps and the fuel-oil pumps are fitted with both steam and electric tracers.

The nitrogen-pressurising equipment associated with the hot water boilers comprises a pressure vessel of approximately 3,500 gal. capacity; a third of its volume containing nitrogen gas. The water-level within the vessel is maintained by two Ronald Trist & Co. Ltd. Mobrey magnetic level switches, one acting as a high-level and one as a low-level alarm, which operate in conjunction with two make-up water pumps of 4,200 gal./hr. capacity against a head of 340-ft., at 2,900 r.p.m. These pumps were supplied by Holden & Brooke Limited. The nitrogen gas is supplied from two banks of four cylinders, and is automatically discharged into the pressure vessel as required, through a valve operated by a float switch. On heating up from cold,

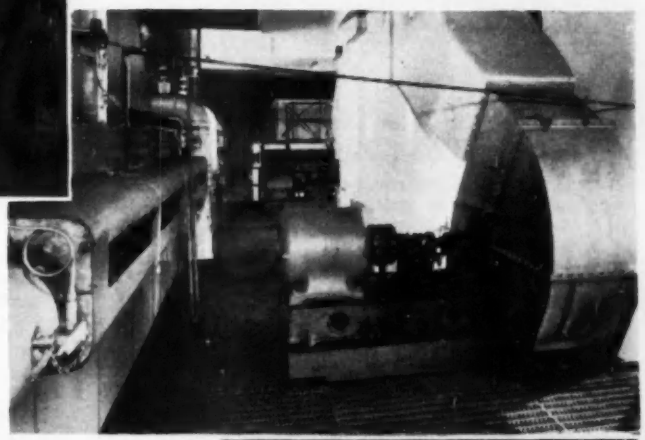
excess water is discharged through a spring-loaded relief valve, loaded to 200 lb./sq. in., which discharges into an open-topped expansion tank of 9,000 gal. capacity. This tank is provided with a cover or float, 16-ft. long and 12-ft. wide, fitting close to the tank sides, so that practically no water surface is presented to the atmosphere, with the result that re-oxygenation of the water is reduced to a minimum. The small amount of make-up water required for this system is pre-treated in a mixing tank, the water being re-dosed under pressure, as necessary.

Both boilers feed into a common-flow header which is tapped for the heating-flow mains, and separately for the process flow mains. Two pairs of circulating pumps for each set of mains were supplied by Holden & Brooke Limited, each pump having a capacity of 640 gal./min. at 1,450 r.p.m. against a head of 100-ft. Mixing valves are fitted between the return and flow on each of the heating and process mains to enable them to be operated at different temperatures independently. The operating flow conditions are designed for 360 deg. F., and normal return temperatures for 300 deg. F.

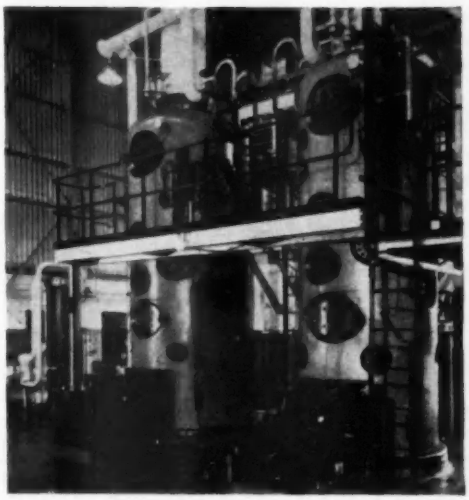
The type of circulating pump supplied was developed by Holden & Brooke Limited specifically for high-pressure hot water systems, where the temperatures involved require that the question of expansion should receive careful consideration. The pumps are mounted or suspended on pillars at the horizontal centre-line to allow for expansion within the pump itself to take place without distortion of the casing or malalignment of the pump and motor. It is necessary that the suction and



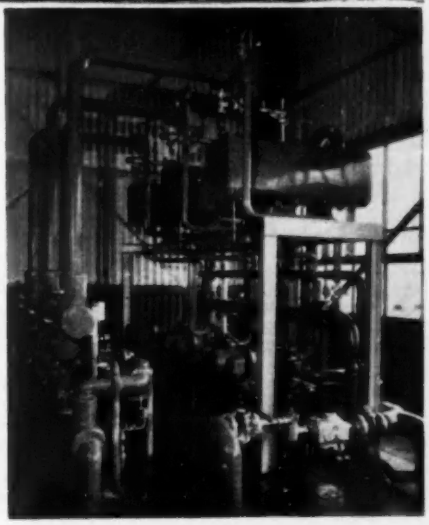
(Above). View at firing floor level of the two La Mont boilers. In the foreground is the 20-million B.Th.U./hr. unit, and in the background the 40-million B.Th.U./hr. boiler.



(Right). View at far-floor level showing "Sirocco" induced-draught fans supplied by Davidson & Co. Ltd., and return water header on the 40-million B.Th.U./hr. boiler.



(Left). The two 3,000 lb./hr. "Thermax" boilers installed to provide steam for heating the heavy fuel-oil burned in the La Mont units.



(Right). The heating and pumping unit which delivers the heavy fuel oil at a pressure of 150 lb./sq. in. and temperature of 250/280 deg. F. to the ring main provided to serve the La Mont boilers.

delivery pipes should be properly secured in order that expansion of these items should take place away from the pump, and at the Dunstable plant no difficulty was experienced in this connection. The bearings are at the extreme ends of the pumps, and in this position do not require cooling, while the glands are adequately cooled by the provision of a cooling-chamber around the stuffing box itself.

(Left). Rear view of the larger La Mont boiler. In the background can be seen the oil transfer pumps supplied by Plenty & Son Ltd.

(Right). The high-pressure hot-water circulating pumps for the heating and process supply. These units were manufactured by Holden & Brooke Limited.

The " Thermax " boilers operate at a maximum working pressure of 100 lb./sq. in. and a minimum working pressure of 80 lb./sq. in., controlled by pressurestats operating on fully-automatic, on/off, pressure-jet fuel-oil burners, supplied by Combustions Limited, and firing 200 sec. fuel-oil, into a combustion space of 75 cu. ft. The burners are provided with integral flame-failure devices and Satchwell controls, incorporated into electrical circuiting, thermally-controlled by relays through an automatic cycle designed to re-ignite the fuel and restart the fuel-oil pump and forced-draught fan ; re-ignition being established by a spark produced by h.t. current through a transformer, operated by a relay. Mobrey magnetic level controls are also fitted on these units as low water cut-outs and alarms. In addition each boiler is provided with a second magnetic level control which acts as an electrically-driven feedpump control. The alarms incorporated are both audible and visual, and the latter cannot be cancelled until normal working conditions are again attained. The two electrically-driven feedpumps provided were supplied by Holden & Brooke Limited, each having a capacity of 600 gal./hr. against a 205-ft. head. A service fuel-oil tank of 4,000 gal. capacity is located inside the boiler house ; the oil being pre-heated by a thermostatically-controlled electric-heater incorporated in the burner equipment.

Falcon Insulations Limited, Bristol, were responsible for the insulation of all pipework within the boiler house. On the high- and low-pressure hot-water, steam and condensate piping the materials used were magnesia sections covered with a hard-setting finish. The oil pipelines, which as previously stated are electrically-traced, were insulated with magnesia covered by sheet-metal cleading ; the insulation on the oil connections to the individual boilers comprising asbestos rope and asbestos cloth. All distribution mains were insulated with Fibreglass rigid sections with a canvas finish ; while the material used for cold-water pipelines was compressed wool-felt sections. In addition Falcon Insulations Limited carried out the insulation work in connection with the boiler flues on both the La Mont and Thermax units. This involved the provision of an air-space, and the use of high-temperature slabs covered with a hard-setting finish.

Instrumentation

For the continuous checking of combustion conditions on all boilers, lossmeters, supplied by Kelvin & Hughes (Industrial) Limited, have been installed, indicating CO_2, CO, H_2 and outlet temperature conditions on one instrument for each boiler, at the same time integrating the readings so that the actual " chimney loss " can be read off the dial ; the readings also being recorded in a separate control room. The Cambridge Instrument Co. Ltd. supplied indicators for flow and return water pressures, for indicating process and heating flow and return temperatures, fan and combustion chamber pressures ; and control room recorders to provide a permanent record of all operating conditions on the high-pressure hot water mains and steam boilers. Electroflo Meters Co. Ltd. supplied meters and recorders to provide the necessary information concerning water-flow rates through each of the mains.

The control room also contains additional indicators showing the temperatures in various parts of the factory area ; quantity of fuel in each tank ; and warning indicators for preventing the over-filling of tanks. Equipment for water testing and a viscometer for the daily checking of the extra heavy fuel-oil, the results of which determine the actual firing temperatures of the oil, are also provided.

Finally, an indicating warning panel which can be observed from the control room, but which is actually situated in the boiler house, together with audible warnings, is provided to cover any eventuality which

might cause damage to plant if not immediately attended to. While the audible warning can be manually cancelled, the indicator panel continues to show the source of trouble until conditions are returned to normal.

In conclusion, we acknowledge our indebtedness to Commer Cars Limited, for granting us permission to publish these notes, and for supplying photographic prints from which the illustrations were reproduced.

GOLIATH CRANE AT HINKLEY POINT

Hinkley Point, Somerset, where the largest atomic power station is now under construction by the English Electric-Babcock & Wilcox-Taylor Woodrow Atomic Power Group, was recently the scene of a spectacular engineering feat, when the 650-ton, 250-ft. long bridge of the world's largest Goliath crane was hoisted into final position 235-ft. above the ground. The crane, designed and built by Babcock & Wilcox Limited, was, in effect, made to "lift itself by its own bootstraps," the

giant bridge being hoisted into position by the crane's own hoisting gears which were already in their position on the bridge, this delicate operation being completed in little over an hour. When completed, this Goliath will straddle the 180-ft. high reactor buildings, carrying major items of equipment weighing up to 400 tons, from the site fabrication area, and facilitating the lifting of the heavy components for the two 250-MW reactors, together with their twelve associated 90-ft. high steam-raising units, which together will produce 5½ million lb./hr. of steam.

THE CYCLONE FURNACE

We had the opportunity recently of attending the showing of a new Babcock technical sound-film describing the principles, features, construction and advantages of the Cyclone furnace—an important modern development in the firing of large central-station and industrial boilers. Introducing the Cyclone furnace with a brief indication of the basic principles, the film opens with views into an actual boiler, showing a Cyclone furnace in operation and the conversion of the ash into a molten slag which flows out of the furnace into a quenching tank. In a brief historical sequence, it is explained that Cyclone-firing represents the most modern development in methods of burning coal for steam-raising. An animated graph emphasises that electricity demand is doubling about every 10 years, and that even with nuclear power plant developments, coal will remain a major source of power for many years to come, with Cyclone-firing a most efficient method of using it in connection with power generation. Cyclone-firing goes far towards a solution of the difficult problem of fly-ash. This is clearly demonstrated by an animated diagram comparing the ash recovery in the boiler, for conventional p.f. firing, for the slag-tap (or wet-bottom) furnace and for the Cyclone furnace, with which only about 10 per cent. of the total ash passes through the boiler as fly-ash. Mentioning that this is only one of the important advantages of the Cyclone furnace, the film proceeds to study its principles and main features, by animated colour diagrams of a Cyclone-fired Radiant-type boiler. It explains that there are two variations of the Cyclone furnace, viz.:—the one with axial entry of the coal, and burning coal crushed so that 95 per cent. passes a ¼-in. mesh; and the other with tangential entry of the fuel, burning coarsely-pulverised coal (50 per cent. passing a 200 mesh). Having dealt with the operation of the axial-entry type, the film illustrates activities at the Renfrew works of Babcock & Wilcox Limited, showing typical Cyclone furnaces under construction, and then shows views taken at a site where a Cyclone furnace is being installed, to show the Cyclone being offered up to the boiler front-wall. By animated diagram, the principles and the features of the tangential entry type are then shown; and this is followed by a works sequence showing Cyclones of this latter type in course of manufacture. The film then takes the viewer to a power station equipped with typical Cyclone-fired boilers, describing the plant, and tracing its operation and control, from coal-handling to slag-disposal. The film has a running time of 30 min., and is available in both 35 mm. and 16 mm. sizes. It is available on free loan to universities, technical colleges, scientific and engineering societies and other engineering bodies. Application for the loan of the film may be made to: Babcock & Wilcox Limited, Publicity Department, 209, Euston Road, N.W.1. Tel.: Euston 4321.

THE LATE SIR JOHN DALTON

It is with regret that we record the death, which occurred on May 14th, of Sir John Dalton, M.I.E.E., F.C.I.S., barrister-at-law, who was a well-known figure in the electrical industry, both on the electricity supply and the cable-making sides, for many years. Sir John, who was 74, had spent most of his career in the electricity supply sphere. He was legal adviser to the former Electricity Commission from 1922 to 1927 and in the last-mentioned year began his long association with the County of London Electric Supply Company, of which (and of its associated companies) he became director and general manager. During the war years (1939 to 1945) he acted as Regional Controller of Fuel and Power for London and S.E. England and chairman of the Public Utilities Coal Committee, and he was knighted in 1942. In 1945 he was appointed a director of the London Power Company, and Central London Electricity Limited. Upon nationalisation of the electricity supply industry in 1948 he relinquished this position and joined the Cable Makers' Association as director. Sir John was appointed chairman of W. T. Henley's Telegraph Works Co. Ltd. in 1953 and held that position until June last year when he resigned from the chairmanship; he later retired from the board. He was chairman of Southern United Telephone Cables Limited, and was also on the board of Henley-Simplex Africa (Pty.) Ltd. Sir John was president of the British Electrical Power Convention, held at Torquay in 1956. He was editor of "Electricity Act, 1926," "Electricity Act, 1947," and of the fifth edition of "Will's Law Relating to Electricity Supply." He was president of the Electrical Industries Benevolent Association for 1953-54.

The English Electric Co. Ltd. announce that **Mr. G. E. Robertson,** A.M.I.E.E., Assoc. Mem. A.I.E.E., has been appointed manager (Sales and Contracts) of the Meter, Relay and Instrument Division, and that **Mr. P. G. Bevis** has been appointed manager (Sales and Contracts), Relay Department.

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Consequent on the decease of the chairman of Prior Stokers Limited, **Mr. F. P. D. Scott,** the managing director, **Colonel A. de Chimay, T. D.,** Assoc. Inst. C.E., Assoc. I.Mech.E., has also been elected chairman. **Major General Sir Miles Graham,** K.B.E., C.B., M.C., a director of the company, has been elected vice-chairman, and **Mr. J. P. Anderson** is taking over the duties of sales director.

British Coal Utilisation Research Association

THE British Coal Utilisation Research Association was formed in 1938, and is now, in its 21st anniversary year, one of the largest of the 39 industrial research associations supported by the Department of Scientific and Industrial Research. The growth of the Association, the terms of which are to "promote research and other scientific work in connection with the utilisation of coal and its derivatives," can be judged by the increase in annual income, which has risen from £28,000 in 1938, to £70,000 in 1942, £201,500 in 1947 and £413,000 in 1958.

To mark their 21st anniversary, B.C.U.R.A. held "open days" at their Leatherhead laboratories, from April 22nd to 24th:—the first day being allocated to members of the Association and special guests, on which occasion the guest of honour at a luncheon was the Rt. Hon. Lord Mills, P.C., K.B.E., Minister of Power. Other distinguished guests were Sir James Bowman, chairman, and Mr. James Latham, deputy chairman, National Coal Board; Sir Harold Smith, chairman, Gas Council; Sir Josiah Eccles, deputy chairman, Electricity Council, and member of council of B.C.U.R.A.; Mr. Richard Fort, M.P., chairman, Parliamentary and Scientific Committee; Dr. B. K. Blount, deputy secretary, Department of Scientific and Industrial Research, and member of B.C.U.R.A. Council; Sir Andrew Bryan; Mr. A. H. A. Wynn, scientific member, National Coal Board, and member of B.C.U.R.A. Council; Sir Harold Hartley, F.R.S.; Mr. T. A. Rogers, president, Institution of Mining Engineers, H.M. Chief Inspector of Mines; Mr. E. M. Edwards, president, Institution of Gas Engineers; Mr. T. C. Bailey, president, Institute of Fuel; and Mr. C. Benham, president, Institution of Heating and Ventilating Engineers. Directors of other grant-aid research associations and of D.S.I.R. permanent establishments also attended, as did a number of university professors whose interests touch upon coal research.

In the absence through illness of Dr. W. Idris Jones, C.B.E., the president of B.C.U.R.A., Sir John Charrington, vice-president, welcomed the Minister. Lord Mills, after wishing Dr. Idris Jones a quick recovery, went on to say that since the Association had been founded, there had been many changes in the fuel situation of this country. The Association started its life at the end of a period of depression which had so seriously affected the coal industry during the 1930s, and was almost immediately faced with equally difficult problems which arose from the war years. This was followed by the pressures of the post-war period, when, for so long, the demand for coal was greater than its supply. Now, there had been yet a further change. Two years ago, we were still importing coal, there was a growing shortage of large coal, and supplies both to the householder and to industry were still under war-time controls. The Government had got rid of the imports and of the controls, and during that time there had been significant—perhaps one should say far-reaching—changes in the whole pattern of coal demand and supply. For the first time in 20 years, the coal industry was operating in a buyers' market:—but the demand for coal generally, had been slackening. It was in competition with other fuels which have considerable attraction for the consumer from the point of view of price, cleanliness and ease of handling. Some of the changes are transitory. For example, the Government is convinced that the actions it is taking to encourage a further move forward in industry will be successful, and will, in turn, lead to a renewed demand for coal. The Minister felt, however, that the time had come when it would be useful for an authoritative and independent body to review the work already carried out and any other possibilities which might offer prospects for expanding the use of coal for the efficient production of chemicals, gas and various types of hydro-carbon oils. He had, therefore, decided to set up a committee under the chairmanship of Mr. A. H. Wilson (research director of Courtaulds Limited) and he very much hoped that, as a result, they may receive a clear indication of the further steps that can be taken in promoting the better use of coal for these purposes. Any help that the British Coal Utilisation Research Association could give to the committee in the course of their work, would be more than welcome.

In conclusion, Lord Mills said that during its first 21 years the Association had made great advances, and had earned itself an international reputation. For this, much credit must go to the Association's staff so ably led by Dr. Townend. They formed an expert and well-balanced team capable of prosecuting research work from basic investigations in the laboratory, right through to relatively large-scale development work. The industrial support received from the nationalised industries and from individual firms and trade associations continued as strong as ever, as does the demand for the Association's services. The Association was assured of their support in the future, and their good wishes for continued success in the years that lie ahead.

Dr. D. T. A. Townend, C.B.E., director-general, B.C.U.R.A., thanked the Minister on behalf of those present, and then asked him if he would make presentations to five members of the Association's staff who had been appointed in 1938—three of whom were members of the Research Department of the Combustion Appliance Manufacturers' Association in that year. Those concerned were R. L. Brown (Director, Basic Research Laboratories); P. G. W. Hawksley (Superintendent, Combustion Department); H. G. Crone (Education Officer); J. S. Hales (Director, Industrial and Domestic Development Laboratories); and Miss M. Campbell.

Annual report

The annual report of the British Coal Utilisation Research Association, covering the year ended December 31st, 1958, contains comprehensive information relating to the Association and its activities during the period under review. Details of some of the work carried out are given below.

The corrosion of low-temperature metal surfaces in boiler plant is probably the most serious problem of boiler availability at present confronting users of water-tube boilers, and its incidence has been aggravated recently by the conversion of a number of large boilers

in power stations from pulverised-fuel to oil firing. Previous work by the Association established that the presence of a considerable excess of combustion air encourages the formation of SO_3, and, recently, this finding has formed the basis of a number of trials on full-scale boiler plant. At Poole generating station, a corner-fired boiler, converted from coal to oil-firing, has been provided with a refractory belt between the burners. With this modification it has proved possible to operate the boiler at the normal rating of 300,000 lb./hr. of steam with less than 1 per cent. of oxygen in the flue gases leaving the superheater chamber. It has been established that a substantial reduction in acid formation can be achieved by reducing the oxygen content to this level, and a relation between the acid dewpoint and the oxygen content of flue gases has been plotted for this boiler. This is a most significant relation, for it implies that by combustion control alone, the formation of SO_3 in oil-fired boilers can be reduced to an extremely low level; thus, not only is corrosion reduced to a minimum, but the quantity of sulphuric acid released to the atmosphere is correspondingly reduced.

During the combustion of coal, sodium is released in a finely-divided form, and the extent of the resulting fouling of boiler tubes is directly related to the quantity of sodium in the fuel. It is also related to a number of other variables, and in order to explore these under closely controlled conditions, a small pulverised-fuel combustor, burning 100-120 g./hr., has been developed. The first series of experiments, on the effect of ash content on the release of sodium from Thoresby coal (1 per cent. chlorine), has been completed; and it has been shown that the amount of available sodium measured at the outlet of the combustor decreased sharply as the ash content of the fuel increased. Previous work on a 50 lb./hr. combustor had shown that both tenacity of bonding and quantity of deposit decreased with increasing ash content, and it may reasonably be concluded from the evidence now available, that the greater the ash content of the coal, the less the trouble that can be expected from bonded deposits.

The effect of the particle size of the fuel upon the release of sodium has also been investigated; from which it is apparent that the smaller fuel shows a distinctly lower tendency to release sodium and hence to foul the tubes. The practical significance of this is not so immediate as that of the previous finding, but it can be argued from the evidence available, that the finer grinding of coals having serious fouling characteristics should be beneficial. It would also seem that the supply of dry ultra-fine coal removed from washeries would be likely to ease the problem of fouling.

The sodium release referred to above relates to that part of the sodium recovered from the combustion gases in a finely divided (aerosol) form. If the aerosols are not deposited on high-temperature surfaces or collected in small electrical precipitators immediately after combustion, they will become attached to or absorbed on the ash particles. A decrease in sodium release means that less active aerosol is available for deposit formation, and that a correspondingly larger proportion is to be found associated with the ash particles.

The experimental plant at Barking power station for studying the formation of sulphur trioxide by catalytic oxidation over heated steel tubes has been in continuous use throughout the year. In this plant flue gases are extracted from the side of a stoker-fired boiler between the screen tubes and the superheater, and equal quantities are passed through two parallel ducts, one containing a large number of mild-steel tubes held between 900 deg. and 1,100 deg. F. (480 deg. and 600 deg. C.)—the other containing little or no high-temperature-metal surface. It has proved possible to obtain reliable and reproducible measurements of the relative amounts of condensable sulphuric acid produced in the two gas streams by means of a system of water-cooled tubes, held at a temperature well below the dewpoint of the gases. It has been established that the high-temperature metal surfaces are responsible for an increase of approximately 100 per cent. in the sulphuric acid content of the gases passing over them. However, the ratio of high-temperature metal surface to quantity of gas passing through the plant is greater, by a factor between three and four, than that found in the average water-tube boiler. The amount of acid generated by catalytic oxidation, compared with that made via other mechanisms in a boiler, has yet to be established, but it is evident that the quantity formed by the former process is important. The amount of acid recorded might be influenced by the amount of dust in the gases; but actual tests showed no significant difference between the total dust trapped in the two ducts of the plant, though there was considerable variation in the concentration of the dust passing into the rig during the test, over a range of 0.2 to 4.0 lb./sq. ft./hr.

Pulverising

Field tests on grinding equipment, development of the cone type mill, and examination of the physical properties of coals have continued during the year. Following an investigation on a ring-ball pulveriser carried out in conjunction with the Fuel Research Station, and reported last year, tests were made on a tube mill at Brimsdown power station. There was no appreciable change in power consumption with variation of coal output, and the mill did not respond easily to changes in load; it thus operated most efficiently at both high and steady loads. With a high moisture content (about 10 per cent.) of the feed, when using one coal, the mill became unstable and a high throughput could not be obtained. The fitting of a classifier should improve fineness, output and stability with the wetter fuels.

Two laboratory cone mills have been used to study the influence, on performance, of variations in feed quality and rate, cone angle and speed of rotation; number, size and position of balls; and of guiding vanes. The effects are complex, interrelated, and occasionally anomalous. High-speed photography of a mill in action showed that most of the effects could be explained by alterations in the trajectories of the coal particles in the mill. The performance of the original mill has been improved; for example, it is possible to obtain a once-through product containing 85 per cent. through a 100 B.S. mesh sieve. The work as a whole has thus given rise to (1) a body of data applicable to the design of any high-speed mill of the ring-ball type, and (2) a new and more rational appliance, the cone mill.

The matrix theory of coal breakage has been applied to data obtained from the cone mill and it has been found that, provided the feed rate is not too great, the per-

formance with a feed of mixed size can be estimated from the behaviour of the individual size fractions.

Earlier work on the physical properties of coal has been extended, and was reported at a conference on the Mechanical Properties of Non-Metallic Brittle Materials convened by the N.C.B. Mining Research Establishment. The effect of water adsorption by a hard coal (Markham Hards) in the temperature range 20 deg. to 180 deg. C. (70 deg.-360 deg. F.) appears to be a two-stage phenomenon. The internal friction shows complex changes with water content and there is also evidence of thermoelastic energy loss. The apparatus is being modified to extend the range of the tests.

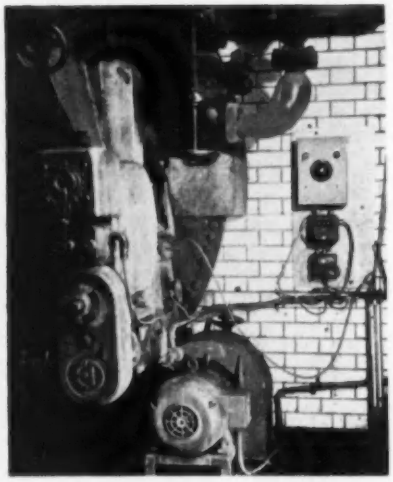
Industrial boilers

The improved use of small coal (below ½-in.) continues to be of major interest in the work on industrial boilers. Five special consignments of a ½-in. washed smalls were used to study the effect of through ½ mm. material on combustion. The samples were prepared at the same washery in the Yorkshire Division, by the National Coal Board, and three contained various amounts of froth-floated filter cake added back at the washery, using belt conveyors but with no other special mixing. The percentage through ½ mm. in these coals ranged from 3.0 to 18.2 per cent. These coals were tested at full rated output in the Economic boiler, being fired in as far as possible optimum conditions by means of a normal chain-grate stoker. The preliminary results showed that there was no significant change in the boiler efficiency over the range of fines content tested; but the carryover of grit and dust into the boiler flues and chimney increased progressively with fines content.

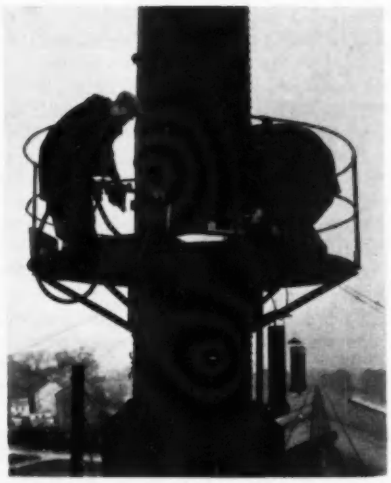
A survey has been carried out on a number of plants to study coal-handling where problems have been reported, or where some novel feature has made the equipment of particular interest. While this survey is insufficient for any general conclusions to be drawn, consideration of eight cases emphasised that (1) where more than one coal was used on the same plant it was the coal with the higher fines content that gave trouble, though the data were insufficient to differentiate between the through ⅛-in. and through ½ mm. fractions; (2) trouble was usually associated with an excessive moisture content; and (3) the principal trouble spot appeared to be the bucket type elevator.

A series of performance trials has been carried out at Leatherhead with the Economic boiler fired by a chain-grate stoker, and fitted with a system of vertical baffles developed to give a more even air-flow distribution through the fuel bed. The results, with coals of different rank, showed that no appreciable drop of efficiency occurred over a range of heat input from 45 to 105 therms/hr. The upper limit represents a combustion rate of about 55 lb./hr./sq. ft. grate area (i.e., 30-40 per cent. above the figure usually quoted).

The air-fuel ratio controller referred to in the 1957 Report has been tested at Leatherhead in conjunction with the Economic boiler using a chain-grate stoker. It has been shown that with a given coal, from 30 to 110 per cent. of the makers' rating, a CO_2 content within ± 1 per cent. can be maintained. The controller has also been tested on a Lancashire boiler in an industrial boilerhouse. It was found that whereas the CO_2 content in an adjacent manually-operated boiler dropped by up to 4 per cent. during changes in load, the boiler with the controller held a CO_2 content between 11 and 13 per cent. throughout the test period except during ashpit clean outs. Air leakages in the boiler brickwork were the cause of the rather low average CO_2 values observed. Arrangements for installing more controllers in industrial boilerhouses to obtain further experience are well advanced.



(Left). The B.C.U.R.A. air/fuel ratio controller fitted to a Lancashire boiler.



(Right). Equipment for dust sampling, developed by the Association, being used for checking the performance of the dust collector installed in conjunction with the experimental Economic boiler at Leatherhead.

Data on heat transfer in shell boilers have been gathered over a number of years and have been re-examined to assess the effects on heat transmission of accidental or deliberately-induced swirl velocities in gases flowing through tube banks. This has enabled precise values and limits of accuracy to be established for the numerical factors in the forced convection equations widely used. It has also enabled the benefits accruing from the use of turbulence promoters to be assessed with precision. Design curves based on this work have been devised to reduce the laborious calculations normally necessary in the design of tube banks.

The heat-flow meter developed for the measurement

of heat transfer through the boiler plate in the Economic boiler has been calibrated in a bench rig to establish the relation between "flowing water" conditions on the cooled side of the heat-flow meter and "boiling" conditions at various steam pressures. The heat-flow meter is now being used to measure the rate of heat transfer through the furnace tube crown at six points.

Tests on the model furnace tube have been continued, to establish the effects of such design features as bridge wall height on the pattern of heat transfer and on the stratification of the furnace gases.

An apparatus has been developed in which any rise in temperature due to delayed combustion in a continuous sample of flue gas drawn from the boiler may be measured. A series of field tests at the Neasden generating station of London Transport gave some indication that such a heat release may occur. Temperature surveys on the air heater of another power station were carried out to explore the difficulties of carrying out an accurate heat balance.

Measurement of grit and dust emission from chimney stacks has now assumed great importance, and much of the effort has been devoted to producing general rules for dust-sampling based on the results of numerous measurement of grit, and dust in stacks. The automatic particle-sizing apparatus developed in collaboration with a member firm has been further tested. The equipment in its present form has a range from about 2 to 50 microns, although below 3 or 4 microns special care must be taken in the preparation of the specimen and in mounting it on the microscope stage. The upper size limit is set by sampling considerations, and a larger stage, which will give a much increased sample area, is under construction by the manufacturers. An advantage of the instrument is its flexibility in regard to the choice of size ranges, but a disadvantage at present is its lack of flexibility in varying the area sampled from range to range. It is possible with the equipment at its present stage of development, to carry out some eight sizings a day compared with the two that can be made by a visual observer. An increase in the speed of sizing would depend on further improvements in detail.

Outlook for Nuclear Power in Australia

ACCORDING to remarks made during a lecture in Sydney recently by Mr. C. N. Watson-Munro, chief scientist of the Australian Atomic Energy Commission, the latest estimates of the growth of electric power in Australia point to an installed capacity of about 35,000-MW (electrical) by the year 2000. From the point of view of supplies of atomic fuel Australia was fortunate in possessing deposits of both uranium and thorium. In view of the low fuel costs and high capital costs of nuclear power stations, Australia would be likely in the future to use nuclear reactors to supply the base load, and coal-fired stations and hydro-electric plants the peak load demands. On this assumption, in the year 2000, it might prove to be balanced economically to have 20,000-MW (E) of nuclear power in a total Australian electric supply of about 35,000-MW (E). If, then, a doubling time of 10 years is assumed for the nuclear reactor plant, a table of the kind given below is produced:

Year	*Total MW (E)*	*MW (E) Nuclear*	*Nuclear (per cent.)*
1975	10,000	3,500	35
1980	13,500	5,000	37
1985	17,500	7,000	40
1990	23,000	10,000	43
1995	29,000	14,000	48
2000	35,000	20,000	57

Breeder type reactors should be developed by 1975, and to feed a breeder system of the kind indicated above, a few thousand tons of uranium or thorium might be required as fertile material. To start the breeder system off, between 3 and 10 tons of fuel would be required. This would preferably be made in nuclear reactors of the natural uranium type as plutonium. To produce five tons of fuel, about 1,000-MW (E) of natural uranium reactor capacity would have to be installed in Australia between 1965 and 1975. There might be areas in Australia, remote from the cheap coal deposits in the Eastern States, where such natural uranium reactors could profitably be installed before 1975. In Great Britain it was expected that nuclear power would become competitive with thermal power by about 1965, but it was likely to be some years after that before nuclear power would be competitive in Australia. A wide variety of possible power reactors was available, but no country had been able to investigate all the schemes it would like to. Australia had agreements for exchange of information with the U.K., U.S.A., and Canada, and she was considering a beryllium-moderated gas-cooled reactor-system, sodium-cooled. The Australian research programme at the Lucas Heights laboratories provides resources of men and facilities for the development of nuclear science and engineering; includes work on the development of nuclear power reactors based on beryllium moderation, as well as on the production of radio-isotopes for research and industrial applications; and provides training facilities for use by universities and industry. The reactor and radioactive chemical laboratories are now in operation, and the post-irradiation facilities for scientific examination of the materials that come out of the reactor are under construction. The aim is to produce a fuel element capable of a rating of about ½-MW (E) per kilogram of fuel, a conversion factor of around 1, and a burn-up of around 1. If this can be done with a high-integrity fuel element, the fuel costs should be less than 1.1d. per kWh. It is hoped to take the first irradiated fuel element samples out of the reactor in March or April, 1960. From the performance of these fuel elements information would become available enabling progress to be made with other tasks, such as the design of layer loops, examination of control and stability problems, construction of zero-energy assemblies to check neutron economics, and examination of chemical processing problems. It would take several years to complete this work, leading up to a reactor experiment, and even after that experiment, some time must elapse before it would be possible to proceed with any power production. It was not easy to predict where and when the benefits of atomic energy would come to Australia, but experience to date showed that atomic energy could make as big an impact on the Australian economy as had the discovery of electricity.

Second Liquid Fuels Conference

A LIQUID fuels conference organised by The Institute of Fuel, and with the overall title of "Major Developments in Liquid Fuel Firing, 1948-1959," was held at Torquay from May 11th to 14th. This was the second such conference to be arranged—the first, "Modern Applications of Liquid Fuels," was organised in co-operation with The Institute of Petroleum and held at Birmingham in 1948.

At the Torquay conference 19 separate papers were presented, each being followed by a discussion; while at the closing session the discussion covered the entire field. It is, of course, impossible for us to deal with all the papers, but we include below abridgments of three of particular interest to readers of this journal.

POWER STATION BOILERS

By K. E. Dadswell, B.Sc. (Eng.), M.Inst.F., and F. R. Thompson, A.M.I.Mech.E. (*Central Electricity Generating Board*).

In 1953 the possibility of the use of oil at certain central power stations was investigated, and this paper outlines the problems involved. In the section devoted to firing equipment the author states that it was at first thought that the least difficult boiler to convert would be one of plain-tube furnace-wall construction, fitted with circular P.F. burners in the front or side walls. It was found in practice, however, that at the stations in which this arrangement existed it was usually more economic to replace the coal-burners by oil-burners of circular-type rather than attempt to adapt the original design to the new conditions.

The corner-fired furnace was a problem in itself. In order to avoid major furnace modifications, it was essential for the oil-burners to be located in the corners. At the time of this decision, there was no experience here of that kind of corner-firing, although in America corner-firing of coal, gas or oil was not uncommon. The main problem was to produce a flame of sufficiently narrow angle to avoid flame impingement on the walls. This involved a departure from normal oil-burner practice, where the short mushroom flame may have an angle of 90°, and intimate mixing of oil and air is relatively easy.

A number of burner manufacturers have carried out considerable research, and produced designs which promise to give every satisfaction. In one design, for instance, up to 20 per cent. of the combustion air can be supplied by a special high-pressure fan, the high air velocity produced being used for flame shaping—that is, it has the effect of closing in the spray angle after atomisation.

With few exceptions, the steam-atomising burner has not been favoured by the C.E.G.B., owing mainly to the uncertainty of its steam consumption. The advantages of high turn-down ratios associated with steam atomising are not considered so essential by the C.E.G.B. because partial load operation is not normally practised. In any event, the turn-down ratios available with high-pressure atomising circulating systems now approach those obtained with steam-atomising burners. Pressure atomising has, however, not been used in the conversion of boilers having furnaces of the Bailey wall type. Extensive modifications to the furnace would have been necessary to accommodate a pressure-atomising burner and the associated air register, and as the manufacturer concerned had a design of steam-atomising burner readily adaptable to the Bailey wall construction, this type was adopted, with considerable saving in time and cost.

Another instance in which the steam-atomising burner has been partly used is in what is normally a pressure-atomising system, except that certain burners are selected for steam atomising for starting-up purposes in a cold furnace. The higher degree of atomising possible in a steam-atomising burner helps to reduce combustion losses in a cold furnace. At some point in the starting-up process, when the furnace is throughly warmed through, the burners are changed over to the pressure-atomising system.

In most conversions, oil pressures of the order of 500 lb./sq. in. have been used, although, when certain units having an evaporation in excess of 1,000,000 lb./hr. were being considered, firing oil pressures of the order of 1,000 lb./sq. in. were contemplated in order to ensure adequate atomisation with the large-capacity burners required.

In units of the size being converted, automatic control of the burner and its ancillary equipment, operated from a control panel local to or forming part of the main boiler control panel, was considered essential. Where adequate cooling of the oil-burner tip when out of service could not be arranged, automatic retraction and insertion of the burner has been provided. Flame-failure detection devices have received considerable attention from manufacturers during the past few years, but there is still room for improvement. Steam or air purging on shutdown has now become general practice; it is essential in order to prevent chokage from carbonisation of the oil in the burner tips.

A number of burner ignition devices are in use, most of them being of the low-voltage high-energy spark type. Usually, these are so arranged that one igniter serves one, or at the most two, oil burners. One manufacturer has, however, reduced the number of igniters required by using an electrically ignited propane-gas flame; this flame, having considerable bulk, can serve all the burners in each corner of a corner-fired furnace conversion.

Flame failure detection, burner ignition and burner purging are all included in the automatic operation sequence where, for example, loss of flame is followed by purging and withdrawal if not re-established within a predetermined time.

Superheater performance

On the question of superheater performance it is pointed out that the higher average emissivity of the oil flame over the coal flame, the greater cleanliness of the furnace wall tubes and lower excess-air conditions in the furnace when operating on oil, all serve to increase furnace absorption, and result in a lower furnace-gas leaving temperature.

It was inevitable that this reduction in total heat in the gases to the superheater would result in a lower final

steam temperature, but it was thought possible that this reduction might be minimised in certain instances where superheaters designed for coal-firing were oversurfaced.

Precautions were taken, however, and, where practicable, the cooling effect of the furnace was reduced by lining the sloping sides of the furnace hopper with 2½-in. refractory tiles; as facilities for coarse-ash removal were no longer required, the ash-hopper outlet was sealed off with a refractory floor spanning the opening. In some instances, a refractory belt was also fitted to vertical furnace walls. Additional high-level oil burners can be added at the top of the furnace to ensure the full steam temperature over the required load range. The recirculation of gases drawn from the economiser exit and introduced into the furnace has, by virtue of the increased gas weight, increased the heat transfer in the superheater, and assisted in raising the steam temperature to the required figure in other installations.

Where tilting burners are in use, this method of steam temperature control has materially assisted in achieving the temperature required, and where a burner arrangement consists of a number of horizontal rows, burner row selection has also helped, especially at loads corresponding to the lower limit of the steam temperature control range.

Boiler-plant efficiency

Discussing boiler efficiency the author states that with oil-firing, the relatively high hydrogen content of the fuel results in a higher moisture loss than is normally experienced with coal, and this tends to offset the gain achieved by using an ashless fuel. Should these considerations cancel out, or even show a balance in favour of oil-firing, as indicated in Table 1, the need to operate at high final gas temperatures on oil results in a gross efficiency somewhat less than that on coal.

TABLE I—COMPARATIVE EFFICIENCIES FOR COAL AND OIL-FIRING

	Coal	Oil	Oil
Gross, B.Th.U./lb.	10,500	18,500	18,500
Moisture, per cent.	13	—	—
Ash, per cent.	15	—	—
Hydrogen, per cent.	3.8	11.0	11.0
Gas temperature, deg. F.	280	280	380
Air temperature, deg. F.	80	80	80
Heat Balance			
Dry gas loss, per cent.	5.22	4.77	7.15
Moisture loss, per cent.	5.08	6.08	6.35
Unburnt loss, per cent.	0.70	—	—
Radiation, etc., loss, per cent.	1.00	1.00	1.00
Total losses, per cent.	12.00	11.85	14.50
Gross efficiency, per cent.	88.00	88.15	85.50

Consideration is also given in the paper to the protection of the heating surfaces of the low-temperature auxiliaries against corrosion; the cleaning of air-heaters and economisers by soot blowers and water-washing; and finally mechanical dust-collectors and electrostatic precipitators.

PRESSURE-JET OIL BURNERS FOR BOILER USE

By A. M. Brown, B.Sc. (*Department of Fuel Technology and Chemical Engineering, University of Sheffield*)

Recent advances in oil-burning technology have resulted in the solution of many of the problems formerly encountered with oil-burners which incorporate pressure-jet atomisers, but the author of this paper suggests that further advances, particularly in the direction of higher combustion intensities, will require much greater application of combustion theory. The present state of knowledge of high-intensity combustion is reviewed, and in this section of the paper reference is made to ideal combustion systems. Here it is stated that in applying the results derived by Longwell to cases of more immediate interest, Bragg has shown that for higher combustion efficiencies in non-premixed systems the greatest intensity is obtained when 85 per cent. of the stoichiometric air is brought into the homogeneous reaction chamber, giving 20 per cent. of the fuel unburnt at the exit. A second chamber is attached where further air, up to 16 per cent. excess, is added. For 99.9 per cent. efficiency this secondary chamber must be the same size as the primary one.

Thring and Masdin have recently suggested that by mixing air stepwise down the chamber each time the reaction rate begins to fall off, even higher intensities could be obtained than in the homogeneous reactor. The effect of this system is compared with a Longwell type reactor, the increase in combustion intensity being about 6 per cent. A good gas-turbine combustion chamber might approximate to something like this. These results must represent the target for practical combustion systems. The Longwell results have been applied to gas-turbine combustion chambers by other workers with some success. The conventional pressure-jet burner system is a long way from this ideal because the flame by no means fills the combustion chamber. The form of the oil spray used is also such that it is nowhere likely to approach a homogeneous mixture with the air, nor is it usually possible to have secondary air jets downstream of the burner as in the gas-turbine chamber. One advantage of a non-premixed system is that, with the correct aerodynamic arrangement, it should be possible to vary the local air/fuel ratio from distinctly rich at the entry to a weak final mixture, as in the Thring and Masdin suggestion, even without recourse to secondary jets. The exact understanding of the optimum course for mixing of fuel, air and combustion products still awaits experimental investigation, and this work is being undertaken by some of the author's colleagues. The theoretical work demonstrates, nevertheless, the great importance of obtaining the correct mixing pattern in the flame; this depends principally on the aerodynamics and is discussed in a later section. To complete this section of the paper actual burner systems are expressed as an approximation of the ideal.

The author then discussed liquid sprays, furnace aerodynamics, and flame stabilisation. The use of model techniques, and the performance of some types of burner are also dealt with, and an indication given of the importance of aerodynamics in the boiler furnace as a whole.

PREVENTION OF CORROSION AND DEPOSITS

By H. E. Crossley, B.Sc. (Tech.), M.Sc., Ph.D., A.R.I.C., F.Inst.F. (*Central Electricity Generating Board*)

This paper first gives information on the occurrence of air-heater blockage and corrosion in power stations in the U.S.A. and France, and the use of dolomite as a corrective additive in some of those stations. The next section of the paper is concerned with full-scale investigations in British power stations to test the effect of reducing

to a minimum the free oxygen in the combustion chamber, and the effects of additives. This is followed by reference to the benefits of operating with high gas temperatures.

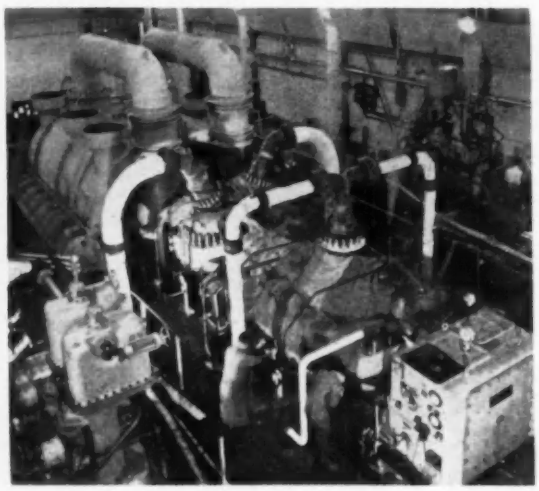
Discussing the most promising methods for prevention of corrosion, the author stated that the prevention of troubles associated with acid in the flue gases from oil-firing has been the subject of a very large amount of experimental work by the electricity generating industry. Experiments are continuing, and an overall assessment of progress may be subject to considerable change at any time. At the time of preparation of this paper, it would seem that for British power stations the best preventative measures to be applied would be the limitation of combustion air to a minimum in all instances, even when modifications have to be made to the plant to achieve this result, and operation with increased gas temperatures as a temporary measure until progress allows a return to normal temperatures. In the author's view, all additives are undesirable, but until the state of knowledge permits operation without additives, zinc powder is at present the most promising substance. The author looks forward to the time when a considerable improvement can be made in oil burners, not only to operate with still less excess oxygen than has been achieved at Marchwood, but also to create a flame which will be semi-reducing in character. It should be possible in this way to prevent the formation of sulphuric acid anywhere in the boiler system, and on first principles the only satisfactory solution to acid troubles with oil-firing would be prevention, and not the application of palliatives.

The above comments are based on the supposition that residual fuel oil will continue to be supplied with sulphur contents in the range 3-4½ per cent. It is known that increases in sulphur content above 3 per cent. lead to considerable increases in the amount of sulphuric acid formed under any given set of conditions, and equally that fuel oils containing 2 per cent. or less of sulphur can be burnt in power station boilers without serious trouble from formation of sulphuric acid. Clearly, the ideal answer to acid corrosion problems in boiler practice would be the reduction of the sulphur content of residual fuel oils, and although such a measure has frequently been described as uneconomic and impracticable, the author feels that the position should be periodically reviewed, bearing in mind the serious troubles which have arisen from high sulphur content and the high cost of providing measures of alleviation.

The final section of the paper deals with the fouling of superheaters, and the author points out that although this problem has not yet become serious in power stations with oil-firing, it may become more serious in the future. It is suggested that the best method of preventing the occurrence of this trouble would be to limit the amount of sodium in fuel oil to less than 10 parts per million.

BRITAIN'S FIRST 200-MW TURBO-ALTERNATOR

The first 200-MW, 3,000 r.p.m. reheat steam turbine, which has been constructed by The English Electric Co. Ltd. for the Central Electricity Generating Board, has now successfully undergone works tests preparatory to being installed in High Marnham Power Station, in the East Midlands Division, and located on the west bank of the River Trent. It is within easy access of the East Midlands coalfields and close to the main railway line linking Chesterfield and Mansfield with Lincoln. It may be remembered that this 1,000-MW station, when completed, will contain five 200-MW " English Electric " turbo-alternator sets and will be the largest not only in Britain, but also in Europe. " English Electric " are also supplying five 415 V switch and control gear units to High Marnham. Delivery of these has already begun and will continue in phase with the commissioning of the main turbo-alternator sets. The new turbine is the largest ever to leave the company's works at Rugby. It is also the first tandem 200-MW steam turbine to be manufactured in Britain. The turbine is typical of the most advanced designs now in course of manufacture by The English Electric Co. Ltd., the largest turbines on order (the largest turbines yet to be built in Europe) being the two 275-MW sets for the Blyth " B " Power Station of the C.E.G.B.



At High Marnham the five turbo-alternator units are arranged in-line along the station at 120-ft. centres. The total weight of one turbo-alternator unit is 1,450-tons, the maximum lift being that of the alternator stator at 168-tons approximately. With a running speed of 3,000 r.p.m., the 200-MW steam turbine is of the horizontal three-cylinder design, having a double casing impulse-type high-pressure cylinder. Steam enters the turbine stop valve at 2,350 lb./sq. in., 1,050 deg. F.—the highest steam conditions so far attained in any British power station. The steam from the high-pressure turbine exhaust is taken to the reheater and then returned to the intermediate-pressure cylinder at 475 lb./sq. in., and 1,000 deg. F. The intermediate-pressure cylinder is combined with one section of the three-flow low-pressure cylinder, and has impulse stages up to the point of exhaust to the low-pressure stages. Approximately one-third of the steam remaining after bleeding passes through the combined low-pressure portion, and the remaining two-thirds is led through two overhead interconnecting pipes to the double-flow, low-pressure cylinder. The three-flow low-pressure cylinder exhausts to a single-shell condenser, the vacuum at the most economical and continuous maximum rating being 28.7 in Hg. (Bar. 30 in.) when using cooling water at 60 deg. F. The condensing plant includes a single-shell condenser, two full-duty extraction pumps, three 50 per cent. duty rotary Leblanc type main air-pumps and two quick-starting exhausters. There is a six-stage feedwater system giving a maximum temperature of 460 deg. F. at continuous maximum rating.

The alternator is of the latest hydrogen-cooled design employing direct cooling of the stator and rotor conductors at a rated gas pressure of 30 lb./sq. in. The hydrogen coolers are arranged longitudinally in the upper part of the stator frame and circulation of the hydrogen through the machine and coolers by means of an axial flow blower. Generation is at 16,500 volts with rated phase current of 7,780 A at 0.9 p.f. The exciters comprise a main and pilot unit arranged back to back on the same shaft and driven through gearing from the tail end of the alternator. They are totally-enclosed and ventilated on the closed circuit principle, the air being circulated through the machines and coolers by means of a direct-coupled fan. The maximum output of the main exciter is 3,000 A at a rated voltage of 520 volts.

The Institute of Fuel—Annual Luncheon

THE annual luncheon of The Institute of Fuel was held on Thursday, April 23rd, at the Connaught Rooms, London, and was attended by some 800 members and guests. The president, Mr. T. C. Bailey, proposing the toast of "The Guests," said that his first duty was to confer on Mr. R. H. Gummer the highest honour the Institute of Fuel could bestow, that of honorary membership. The Institute reserved its honorary membership for only the most distinguished men; until that day it had only three—H.R.H. the Prince Philip, Duke of Edinburgh; Emeritus Professor Morris William Travers; and Sir Ernest Smith. It now added a fourth, a man who had had a distinguished career in fuel technology, who was a founder member and a past-president of the Institute, and who, by his work as its honorary treasurer, had done as much, if not more, than anyone to build up the Institute to become one of the leading professional and scientific institutes. The president then presented the Bone-Wheeler Medal, and a prize of £50, given by the Board of the National Industrial Fuel Efficiency Service, to Mr. M. V. Murray, for his paper "The Performance of an Overfeed Coking Stoker." The highest technical award which the Institute could bestow, the Melchett Medal, was then presented to Dr. P. O. Rosin.

"Men of vision"

Continuing, Mr. Bailey paid tribute to the officers and council, and to the staff of the Institute, saying that they must not forget those men who went before them—men of vision, who, in the days of abundant and cheap supplies of solid fuel, were able to look into the future and see the day was coming when the whole prosperity of the nation would depend on fuel efficiency and fuel economy. Some of these men were present, and he particularly mentioned Lord McGowan of Ardeer, who was president of the Institute 25 years ago. Also among the guests were other past-presidents, Dr. D. T. A. Townend, Mr. R. H. Gummer, and Mr. H. McNeil.

A welcome was also extended to Sir Dennis Proctor, the permanent head of the Ministry of Power, and to guests from overseas, including Mr. E. Martin, the Economic Minister at the United States Embassy in London; and from the Commonwealth Mr. R. Durie, who represented the High Commissioner for Australia, and Col. the Hon. Sir William Leggatt, Agent General for Victoria.

Finally, Mr. Bailey said, the toast was coupled with their guest of honour, Mr. C. M. Vignoles, president of the Institute of Petroleum and managing-director of Shell-Mex and B.P. Limited. Mr. Vignoles had varied and widespread interests, but on this occasion he was welcomed as an outstanding representative of the oil industry, a man who took the keenest interest in the Institute of Fuel, and who was rightly regarded as one of its truest friends.

In reply, Mr. Vignoles said that those in the oil industry were especially concerned that the place of oil in our national fuel pattern, and indeed in our national economy generally, should be properly understood and seen in its true perspective. Recent events had led a great many people to be pre-occupied with the competitive aspects of fuel supply, and he suggested that many of the statements made in recent months could have generated a little more light, and a little less heat, if they had been based on the broader approach which was represented so well by the Institute of Fuel. The broad basis of our national economy was, of course, the British coal industry. No supposed sectional interest could affect that, because as a nation we could never realise the full promise of our great industrial resources, and make the material advances we all hoped for, unless and until we could build upon the foundations of a prosperous—by which he meant an economically sound—coal industry.

Mr. Vignoles then spoke of the difficulties encountered by the Coal Board, and of the new plans for the reduction of coal output—a difficult, but entirely realistic decision which courageously recognised that the day was past when, broadly speaking, any fuel at any price could find a market—a truth of which all fuel producers, not only the coal industry, must now take note. As a nation we lived by our exports. British industry must keep its production costs as low as possible and, in particular, must have access to the cheapest sources of raw materials and fuels. Our fuel industries existed primarily to keep our manufacturing industry at the peak of competitive efficiency; and for that reason the British manufacturer should decide his own fuel needs. Any arbitrary and artificial adjustment of the pattern, made in the supposed interests of one fuel industry or another, would impair that freedom of choice, and thereby the efficiency on which depended all our national hopes of increasing prosperity in the future. He hoped that in its post-war policies the British oil industry could claim to have been guided by the principles of common-sense fuel selection and efficient fuel usage. They had never suggested that oil would or should meet all the increasing demand for energy, but only that it could make an important and extensive contribution, primarily, where its special properties gave it definite advantages in terms of production efficiency. These advantages had now been firmly established for numerous industrial applications, where it was now clear that a reversion to any other fuel would mean a handicap to the industries concerned. That, rather than any bare statistics of the rise in oil consumption, was the true measure of the value and importance of the oil industry to British industry as a whole.

Britain's share in world oil industry

The value of the oil industry as an intrinsic part of our national economic effort was just as striking. This was often forgotten because of a basic misunderstanding about British interests in the international oil industry. It was very much more than the interests of a consumer. Britain had always had a substantial share of the world oil industry, and in recent years our holding had been steadily growing. Today they produced, in association with Dutch interests, roughly one-third of all the oil entering international trade. On the marketing side they had handled in recent years up to 50 per cent. of world trade outside the U.S.A. and U.S.S.R.

One of the most important features of post-war

industrial development in Britain had been the creation of a major refining industry, and this had made possible another addition to our industrial effort—the new and rapidly growing petroleum-based chemical industry. Further, our interest in the petroleum industry was by no means limited to the production and processing of oil products themselves. The oil industry was of considerable importance as a customer of British industry generally, notably of shipbuilding and engineering, and through these industries, of steel and coal. It was also proper to mention that the international scope of home-based British oil interests and their overseas operations brought valuable earnings of foreign exchange to our trading account. In fact, these earnings represented the largest single item in our "invisible" exports. The oil industry was now an integral and important part of our national economy.

In conclusion, Mr. Vignoles hoped that what he had said established in everyone's minds the right of this particular fuel industry to work and trade in this country unhindered by preferential barriers of any kind. The efficiency and prosperity of our fuel industries was a problem to be tackled in terms of their ultimate service to our national life, and not in negative and restrictive terms of their impact on each other. The Institute of Fuel was never likely to fall into error of this kind. It provided a meeting point for fuel technologists in all fields, without discrimination or favour of any kind. It stood for the principle that the application of scientific knowledge to the best advantage was work in which all should share and from which all would benefit.

Presidential address

On the previous day (April 22nd), Mr. T. C. Bailey had presented his presidential address, entitled "Oil Burners—1859 to 1959," to a meeting of The Institute of Fuel in London. This year marks the centenary of the drilling of the first oil-well in America, and his opening remarks were of a general historical nature. In the main part of his address, Mr. Bailey dealt with early oil-burners produced in Russia, the U.S.A., France and Great Britain. These were mainly burners using the steam-atomising principle, but by 1902 a milestone in burner development was reached when Korting invented the first of what today are termed pressure-jet burners. The development of these were described, while the latter part of the address covered various other types, i.e., rotary burners; low- and medium-pressure air burners; fully-automatic burners; concentrated-combustion burners; and self-proportioning burners. In conclusion, Mr. Bailey said the British oil-burner industry could undoubtedly claim to have taken the lead between the two World Wars in improving the efficiency of oil burners and oil burning. The design of burners will no doubt go on improving, and designs of future burners will probably achieve even finer atomisation and the ability to burn oil with no more than its theoretical quantity of air.

DISMANTLING OF BANKSIDE "A" POWER STATION

As the next step towards the completion of the Central Electricity Generating Board's Bankside station, the original "A" station was closed down on March 24th, after nearly 70 years of operation. Half of the new station is, of course, already in commission and the board's intention to proceed with the building of the second half was announced last year.

View in the turbine house at Bankside "A" power station which was closed on March 24th, 1959, and is now to be dismantled.

Work has already begun on the dismantling of the old plant, the contract for its disposal having been awarded to George Cohen, Sons & Co. Ltd. Opened in 1891, Bankside "A" was a pioneer station, being for many years one of the largest in the country and being responsible for supplying the whole of the electrical power requirements of the City of London. This plant, now to be dismantled, comprises 18 boilers, complete with coal and ash-handling plant, evaporators, de-aerators and water-softening plant; and eight turbo-alternator sets with an aggregate installed capacity of 85-MW. The boilers include 12 Babcock & Wilcox type C.T.M. units each of 50,000 lb./hr. capacity at 250 lb./sq. in. and 606 deg. F. Six of these boilers are fired by Babcock & Wilcox chain-grate stokers; two with Bennis chain-grate stokers; and four with burners supplied by Wallsend Slipway & Engineering Co. Ltd., for firing coal-tar fuel. Six Yarrow boilers, of later date, four of 65,000 lb./hr., and two of 75,000 lb./hr. capacity have integral superheaters, Green's horizontal "Tri-tube" economisers, and Yarrow tubular-type air-heaters. Five of these units are fired by Bennis chain-grates, while the sixth is fitted with a Bennis carrier-bar drop-link type of grate. Evaporators and de-aerators were supplied by G. & J. Weir Limited, and the condensing plant by Mirrlees Watson & Co. Ltd. The generating plant consists of seven turbo-alternators—three Oerlikon, and four B.T.H.—and a Parsons d.c. generator. Like the boilers, the generating equipment was installed over a long period, and while certain of the older plant will, it is anticipated, be scrapped, there is every likelihood of the more recently installed items, such as the six Yarrow boilers, a 5-MW Oerlikon, and two 10-MW and one 15-MW B.T.H. turbo-alternator sets being removed for use elsewhere, possibly overseas.

Correction

In making reference, in the May issue of this Journal, to the appointment of Dr. D. C. Gunn, B.Sc. (Eng.), M.Sc., etc. (until recently deputy-director of Industrial and Domestic Research Laboratories, British Coal Utilisation Research Association, Leatherhead) as chief engineer to Cochran & Co., Annan, Ltd., Mr. Gunn's name was incorrectly spelt Dunn. We apologise for this error.

RECENT *Equipment* AND *Accessories*

Portable de-ionisation plant

A self-contained, portable de-ionisation plant for producing chemically pure water, has been designed and made by John Thompson-Kennicott Limited. Unique, in that it can be taken almost anywhere, to be immediately connected-up to an existing water supply, the plant is capable of treating between 1,500 and 2,000 gal./hr. of water. After treatment in this new de-ionisation plant, the water becomes the equivalent of, or better than triple-distilled water, and is claimed to have a resistance greater than 2 million ohms. The first use of the new plant is being made at Berkeley nuclear power station, where it will produce the chemically pure water which is required for the testing and the initial operation of the 16 heat-exchangers or steam-raising units. The accompanying illustration shows the plant leaving the John Thompson-Kennicott Works at Wolverhampton for Berkeley, where the nuclear power station is being constructed for the Central Electricity Generating Board by the A.E.I.-John Thompson Nuclear Energy Company. After service at Berkeley, the unit will be available for use at any power station (either nuclear or thermal) where water of the highest quality is required for testing and plant commissioning purposes. (*John Thompson-Kennicott Limited, Wolverhampton.*)

Fig. 1 (left). The John Thompson-Kennicott portable de-ionisation plant, which is capable of treating between 1,500 and 2,000 gal./hr. of water. (John Thompson-Kennicott Limited.)

Four-point temperature recorder

Fielden Electronics Ltd. have now made available a new transistorised four-point temperature recorder. This has a 10-in. dia. chart and operates from the normal 50 c/s mains electricity supply. Resistance bulbs are used as the temperature sensitive elements and low-range spans are easily achieved. The use of transistors has, the company claim, significantly reduced the power dissipated in the instrument, and has resulted in improved performance and greater reliability. Particular features of the unit are the new and improved stability control, and the high reproducibility. The instrument is also available as a single-point recorder with electrical or pneumatic control. (*Fielden Electronics Ltd., Wythenshawe, Manchester.*)

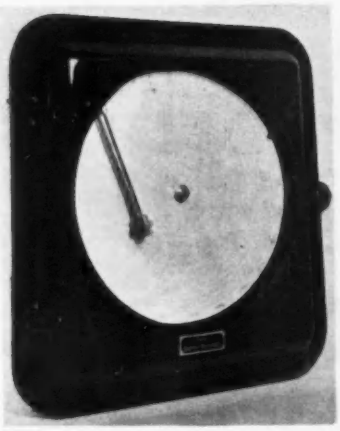


Fig. 2 (above). The new Fielden four-point temperature recorder. (Fielden Electronics Ltd.)

Selector or directional valve

Hunt & Mitton Limited announce that they have added to their range of equipment a selector or directional valve suitable for air, oil or water, at pressures between 10 and 150 lb./sq. in. With the bottom port connected to the work (for example, a diaphragm top or cylinder) it makes possible two independent sources of control, usually automatic and manual. This facility is particularly useful when setting up an operation on a machine for the first time, while in addition it can ensure continued operation, despite temporary breakdowns in, for example, an electrical circuit. The only moving part of the valve consists of a synthetic rubber ball, which is arranged to seal the supply port not in use, and admits the supply to the work. (*Hunt & Mitton Ltd., Oozells Street, North Birmingham, 1.*)

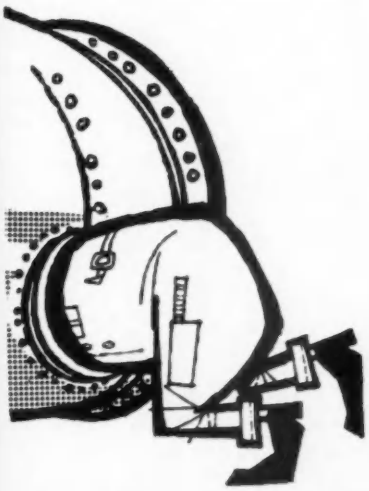
Toroidal voltage regulators

Foster Transformers Ltd. have announced a new range of toroidal voltage regulators. Four basic sizes will be available, and all units will be designed for a nominal ratio of 240/270-V or 240/240-V. Additional tappings are provided at approximately 25, 50 and 75 per cent. of the winding for use with auxiliary transformers. The "Troidac 2.5," with a rated current of 2.5-amps., maximum 3-amps., is of unusual construction in that the core and the winding, apart from the brush track, are encased in a polyester resin material. This arrangement protects the winding against damage in the "back of board" version and provides a fully-insulated and robust portable unit. The "Troidac 10" will also be a resin cast unit, whilst the "Troidac 20" is air-cooled. The "Troidac 40" is an oil-cooled unit rated at 40-amps. from 0 to 240-V, and 35-amps. from 240 to 270-V. A single unit will provide approximately 9.5-kVA of control, and a three-unit version can be provided. The fact that the track and brushgear on this unit are under oil is particularly advantageous for use where adverse atmospheric conditions prevail. All the regulators are wound on cores consisting of "cold rolled" spirals, and the flux density is kept low to avoid undue distortion of the output voltage waveform. In addition to the simple, hand-operated units, these regulators will be incorporated in Foster test equipment. They are also available in motor-operated form, either as voltage regulators or as voltage stabilisers. (*Foster Transformers Ltd., South Wimbledon, London, S.W.19.*)

Inactive hot metal mixers

Two Wellman inactive hot metal mixers, each of 800-tons capacity, have been made by Newton Chambers and Co. Ltd., and are to be supplied

Anybody in your place
RAISING CAIN
about the cost of
RAISING STEAM?

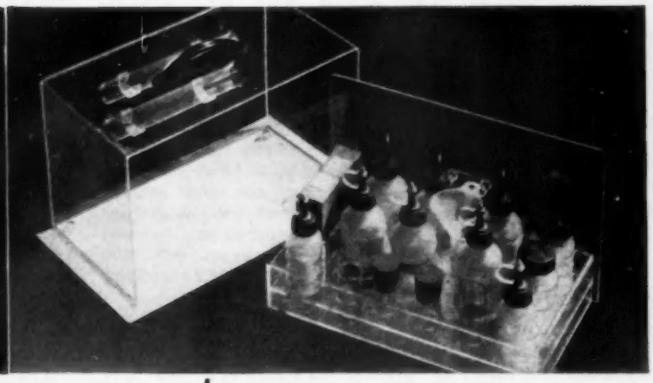


PHOSPHATES
in boiler water treatment

Phosphate conditioning of boiler water is thoroughly established as the most satisfactory method of preventing scale deposits in all types of boilers. Scale cannot form when a reserve of phosphate is present in boiler water. Phosphate conditioning is indispensable at high pressures, and leads to such improvements at low pressures that it is generally preferred to other treatments. Ask your supplier of boiler conditioning chemicals how little you would have to pay to be sure your boiler is scale free all the time.

CONTROL IS SIMPLE

Control of PHOSPHATE CONDITIONING and testing of raw and softened waters is a simple matter using Albright & Wilson's WATER TESTING KIT



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to the new steelworks at Durgapur, India. They were fabricated to the design and on the instructions of the Wellman Smith Owen Engineering Corporation Limited, one of the members of the British Consortium concerned with the construction of the new steelworks. Both mixers have an outside shell diameter of 21-ft. 3½-in. and a length of 37-ft. The company are also supplying other equipment to the Durgapur works, including transportation equipment such as 90 ingot casting cars, 260 charging boxes, charging box bogies, and structural steelwork for ladle cranes. (*Newton Chambers & Co. Ltd., Thorncliffe, Nr. Sheffield.*)

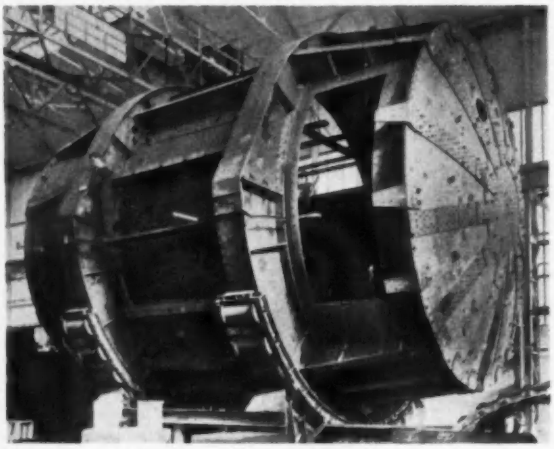
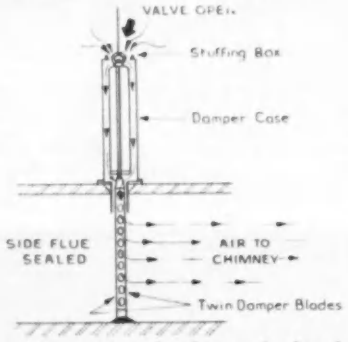


Fig. 3 (left). One of the two inactive hot metal mixers fabricated by Newton Chambers for the Durgapur steel works. (Newton Chambers & Co. Ltd.)

Fig. 4 (below). Outline arrangement showing "Air-Lok" damper in closed position. (Combustion Equipment Limited.)



New sliding-type damper

Combustion Equipment Limited announce an entirely new damper (Patent Application No. 10080/58) which is primarily intended for installation in the side flues of Lancashire boilers. It is known as the "Air-Lok" damper and is of the sliding-type, specially constructed to ensure that when the damper is in the fully-closed position, no air can be drawn past it through the boiler and setting. Thus heat losses during stand-by periods are very much reduced. Furthermore, when in the open or working position no air can leak past the damper blades; thus draught losses are reduced and thermal efficiency increased. The "Air-Lok" consists of two parallel blades about 6-in. apart, held together by webs or spacers and forming a single casting which slides within a frame. The webs or spacers are perforated for the sake of lightness, and also to permit the free flow of air in the space between the blades. Mounted on the frame with an air-tight joint is the cylindrical damper case which receives the damper blade when it is in the open position. The top of the damper itself is connected to the sealing tube which passes through a stuffing box provided at the top of the damper case. The stuffing box and the sealing tube together act as a valve which is closed when the damper is open, and open when the damper is closed. The inlet area of the valve is many times that of the leakage area (the clearance between the edges of the blades and the frame), and it is obvious that when the damper is in the closed position, any air drawn past the damper blade nearest the chimney will be supplied through the valve and not through the boiler. The damper blades and the frames in which they slide are cast in Meehanite type GE., while the damper case is fabricated from ⅛-in. thick mild-steel sheet and the sealing tube from 16 S.W.G. mild steel, both being of all welded construction. A ⅜-in. dia. mild-steel rod passes through the sealing tube being connected to the damper blades at the bottom and to an eye-bolt at the top. (*Combustion Equipment Limited, 61, Belsize Lane, N.W.3.*)

Large mobile vacuum cleaner

The National Coal Board have recently taken delivery of a 14-ton, high-power mobile vacuum cleaner, which is to tour collieries in the Midlands where it will be used for cleaning boiler flues and coal screening houses. The equipment, which was designed and manufactured by the British Vacuum Cleaner & Engineering Co. Ltd., is with its trailer, more than 22-ft. long and 15-ft. high. It has been shown to have a rate of dust removal of over 4-tons/hr. In the restricted space of a boiler flue of some 42-in. dia., dust deposits are often encountered for the whole length of the flue, a distance of some 20-ft. The rate of operation of the mobile unit will, it is claimed, enable an operator to complete the cleaning of such a flue in approximately 30-min., and a whole battery of boiler flues can be effectively dealt with in a normal day's work. An advantage claimed for the unit is that, in many circumstances boilers can actually be cleaned while they are still comparatively hot, thus avoiding the additional loss of efficiency through periods of shutdown. Taking all cost factors into account colliery officials have estimated that the plant will show a saving of approximately 80 per cent. over conventional methods of cleaning. (*British Vacuum Cleaner & Engineering Co. Ltd., Goblin Works, Leatherhead, Surrey.*)

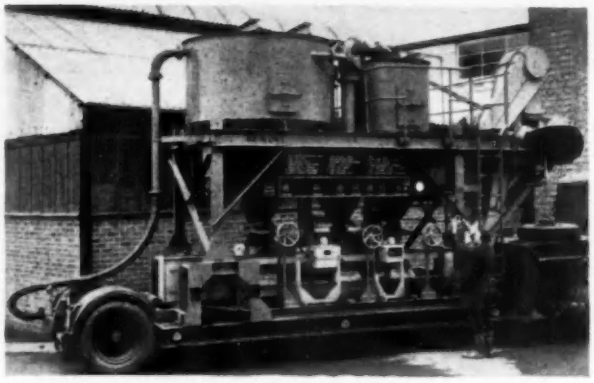


Fig. 5. The 14-ton mobile vacuum cleaner which is to tour collieries in the Midlands area. (British Vacuum Cleaner & Engineering Co. Ltd.)

Pneumatic register

The Lucas pneumatic register for boilers has a burning range of 9,000,000 B.Th.U.'s and upwards, and was shown for the first time at the recent Engineering, Marine, Welding & Nuclear Energy Exhibition in London. Local operation of the register can be effected readily with conveniently situated air-valves obviating all electrics, and the pneumatic control can be arranged to operate either manually, assisted by local or remote servo-control, or fully-automatic. The register, comprising a fuel-sprayer mounted centrally in an air duct located in the furnace quarl, has a sprayer tube and combustion air duct retractable from the heating zone of the furnace by means of rams operated by service air, which presents a safe and readily available medium. The sprayer and air duct are mounted on two concentric tubes which respond to air pressure (directed by a control valve) applied to the front or rear face of a piston integral with the tubes. Manual overrides can be used in case of trouble and safety devices prevent incorrect operation. A damping arrangement to prevent impact damage at the ends of travel of the pneumatically-operated piston is included. Ignition and flame failure devices are also incorporated. (*Joseph Lucas (Hydraulic & Combustion Equipment) Limited, The Radleys, Birmingham, 3.*)

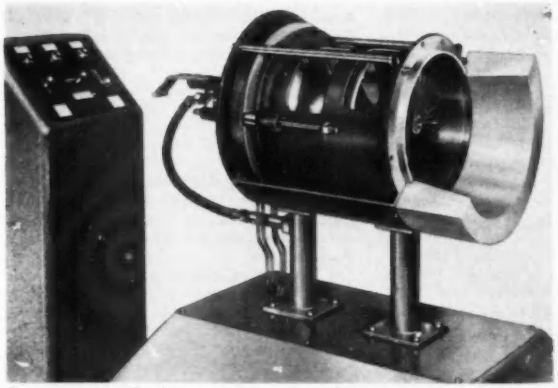


Fig. 6 (left). The Lucas pneumatically - operated register for boilers. Joseph Lucas (Hydraulic & Combustion Equipment) Limited.

Lighter "Monobloc" pumps

Worthington-Simpson Limited inform us that the advantages of the space and weight-saving design of "Monobloc" pumps have been increased still further by the introduction of class "E" insulated motor windings. As a result, the company can now offer smaller, lighter pumps in their 1½ to 10-h.p. "Monobloc" range which give the same performance as comparable units previously fitted with class "A" motors. An example from the pump range with class "E" insulated motor was shown at the recent Engineering, Marine, Welding and Nuclear Energy Exhibition. The motor was fitted to a two-stage "Vortex" pump and was rated at 5-h.p. The pump had a maximum capacity of 520 gall./hr. and a maximum head of 540-ft., depending on capacity. Dimensions and weight of this unit are:—length 2-ft. 1-in., width 9-in., height 1-ft. 2-in. and weight 175-lb. By comparison the same pump-end fitted with a 5-h.p. class "A" motor has a length of 2-ft. 0⅝-in., is 11-in. wide, 1-ft. 2¼-in. high and weighs 216-lb.

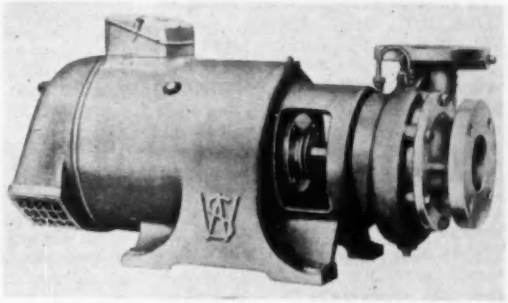


Fig. 7 (right). A Worthington-Simpson type-"DM" Monobloc pump with 10-h.p. Class E insulated motor. (Worthington-Simpson Ltd.)

All units in the Worthington-Simpson "Monobloc" ranges will become available with class "E" motors, including those units which normally have motors with totally-enclosed fan-cooled enclosures. (*Worthington-Simpson Limited, Lowfield Works, P.O. Box 17, Newark, Notts.*)

Chloride testing set

For estimating the chloride contents of both the feed and boiler water, Paterson Engineering Co. Ltd. have now made available a chloride testing set. Feedwater is tested by adding two drops of potassium chromate indicator to 70 ml. of feedwater in the porcelain basin provided, and then adding silver nitrate solution from a special burette, until a permanent pink colour is obtained. The number of millilitres of silver nitrate used is equivalent to the concentration of chlorides as chlorine in grains per gallon, and the conversion to sodium chloride is effected by multiplying this figure by 1.65. To test the boiler water, a very small quantity such as 7 or 10 ml. is used. Two drops of phenol phthalein indicator are added and the alkalinity is neutralised by adding sulphuric acid until the colour is just discharged. The same procedure as for the feedwater is then followed and the burette reading is multiplied by 10 if 7 ml. of water, or by 7 if 10 ml. of water have been used, the resultant figure representing the grains of chlorides as chlorine in one gallon of water. The chlorides in the boiler water divided by the chloride content of the feedwater indicate the concentration of the boiler water. The approximate total of soluble solids contained in a sample of boiler water can also be rapidly ascertained by means of a hydrometer produced by the Paterson Engineering Co. Ltd. The sample is cooled to 60 deg. F., and is thoroughly mixed before filling the hydrometer jar. A reading is then taken from the hydrometer and after correcting it for temperature variation, ascertained with the thermometer also provided, it is multiplied by 7.8, the product being grains per gallon of total solids. When the hydrometer is used in conjunction with the chloride testing set, the approximate composition of the total soluble solids in the water can be calculated. (*Paterson Engineering Co. Ltd., 129, Kingsway, London, W.C.2.*)

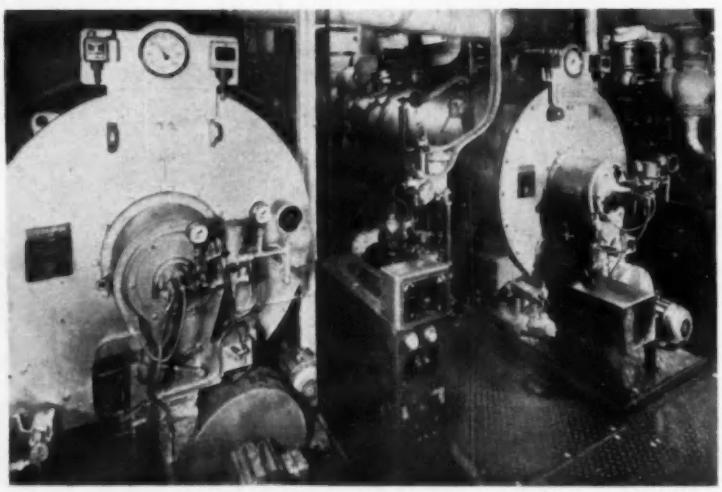
Specialised brazing

Newton Victor Limited, the X-ray department of Metropolitan-Vickers Electrical Co. Ltd., has recently introduced a new service to industry—specialised brazing. This service is being provided at the department's Finchley works, where specialised brazing plant is used in the manufacture of X-ray tubes and valves. It will be of particular interest to firms whose work would not justify the installation of costly equipment. The plant provides for the high quality brazing of components in controlled atmospheres and under vacuum. It includes radiation and muffle furnaces, with which temperatures up to about 1,800 deg. C. can be achieved,

so that no torch or flame is needed; these furnaces will handle parts up to approximately 3½-in. square, and up to 10-in. long. There are also "eddy current" furnaces, which give fairly local heating and temperatures in excess of 1,100 deg. C. and which are suitable for the brazing of circular components; these will deal with items up to 3½-in. dia. and up to 3-ft. 6-in. in length. The joints catered for include stainless steel to stainless steel; stainless steel to steel; copper to steel; steel to steel; copper to copper; steel to Nilo K; and Monel to other metals. A method of brazing beryllium has also been developed, and applications for tungsten brazing can be investigated. (*Newton Victor Limited*, 132-135, *Long Acre*, *London*, *W.C.*2.)

PACKAGED BOILER FOR SEA-GOING FISH FACTORY SHIP

In past issues of this journal we have made reference to installations of Spencer-Bonecourt-Clarkson Limited Steambloc "packaged" boilers in various industrial plants. We have now received details of the first marine application of these units, viz: in the new fish-factory vessel M.V. *Fairtry II*, recently completed by Wm. Simons & Co. Ltd., Renfrew, for Chr. Salvesen & Company, Leith, Scotland, and which is now on her maiden voyage. The two Steambloc No. 120 fully-automatic, oil-fired boilers, installed to provide process steam, each have a capacity of 3,000 lb./hr. (from and at 212 deg. F.) at a working pressure of 145 lb./sq. in. They have been slightly modified for marine usage, and are fitted with twin Mobrey controls providing low-water cutout and pump operation to counteract the effect of rolling conditions at sea. Electrically-driven reciprocating feedwater pumps are fitted to enable water to be drawn up from double-bottom tanks. The burners are ignited by diesel ignition instead of using butane gas, and the boilers operate in conjunction with a waste-heat boiler. Although this is the first application of a Steambloc unit in a sea-going vessel, over 400 land-based installations are already in successful operation in Great Britain alone.



The two No. 120 Steambloc packaged boilers installed on the new fish factory vessel, m.v. "Fairtry II." Each unit has an evaporative capacity of 3,000 lb./hr. at a working pressure of 145 lb./sq. in.

The fifty-fourth annual dinner of the **Institution of Engineers-in-Charge** was held in London on May 1st, with the president, Sir Harold Roxbee Cox, in the chair. The principal guest was Sir Christopher Hinton who, in proposing the toast of "The Institution," commented that engineering was becoming more and more a subject in which theory was being given great weight. It was, he added, a matter for satisfaction that, in the main, the Institution of Engineers-in-Charge consisted of people who were doing "real practical engineering work."

* * *

The Poplar fuel oil terminal of **Charrington, Gardner, Locket & Co. Ltd.,** a description of which was included in the October, 1958 issue of this journal, is, after less than a year's operation, to double its capacity. At the present time there is storage for 4,160,000 gal. of fuel oil; the new tanks, now being erected at a cost of £120,000, will provide for an additional 4,590,000 gal. The main contractors for these extensions are Whessoe Limited, of London, and work is expected to be completed by September of this year.

* * *

A new 14-page brochure (Publication C1) issued by **Turbine Gears Limited,** Cheadle Heath, Stockport, describes three types of couplings manufactured by the company. These are the rigid-type, pin-type flexible, and gear type flexible couplings.

The Central Electricity Generating Board have received the consent of the Minister of Power to the building of the largest power station yet projected in the British Isles. It will be constructed at Drakelow, near Burton-upon-Trent, and will have a total output capacity of approximately 1,500-MW. The Drakelow site is on the fringe of the East Midlands coalfield which is a major source of the low-grade coals used in the production of electricity. Here, a 240-MW station, Drakelow "A," was commissioned in 1954, and a second station, Drakelow "B," with a capacity of 480-MW, is now being built. The new station will be known as Drakelow "C." The site is also in close proximity to the areas of heavy electrical demand in the Central Midlands Area, and the station is thus well-placed to supply those areas with electricity at minimum production cost. As it is also at a focal point of the 275-kV Supergrid system, the output of the new station can be fed into the system without the construction of additional overhead transmission lines. The steam conditions and size of the boilers and generating units to be installed in this new Drakelow "C" station have yet to be determined, and will depend on technical developments in boiler and turbo-alternator design.

* * *

The **George Kent Limited** mobile-exhibition, now carrying out a nine-week United Kingdom programme covering a route of over 1,600 miles, is scheduled to stop at approximately 30 different locations. It is being made available for inspection by engineers and industrialists between Cardiff, Glasgow and Scunthorpe, and features a selection from the wide range of Kent industrial instruments and controls. This travelling showroom, in the last months of 1958, aroused a great deal of foreign interest during an extensive overseas tour which included the Scandinavian countries, Belgium, and East and West Germany.

* * *

An order of £20,000 value has been received by the **Gresham Transformer Group,** Hanworth, Middlesex, from the Ministry of Works of H.M. New Zealand Government for eight 1,667-kVA, 33-kV transformers single-phase. These will operate in two banks, and will have on-load and off-load tap changing equipment, as required.

* * *

The Earl of Halsbury, F.R.I.C., F.Inst.P., has been appointed to the Board of Lancashire Dynamo Electronic Products Limited, as chairman. Lord Halsbury is vice-chairman of Lancashire Dynamo Holdings Limited, and also has a number of other board appointments with industrial organisations.

Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Air-cooled contact-condenser

This invention relates to air-cooled contact-condensers in which steam is condensed by direct contact with water, and the mixing-condenser is connected to a heat-exchanger through which the water circulates while cool air flows over the outside of the heat-exchanger pipes. Special provision is made to prevent freezing in the case of the outside temperature being below the freezing point, when the amount of steam flowing through the steam turbines is reduced and also when the turbines are started. The cooling tower shown in Fig. 1 consists of a base (1) on which rests the actual cooler consisting of heat-exchangers (2) built up of ribbed pipes. A column (3) is mounted in the centre to support a ventilator (4), which draws in the cooling air from the outside between the individual heat-exchangers (2) in the direction of the arrows (5), pressing in the direction of the arrows (6) into a diffuser (7). The heat-exchangers (2) constitute the vertical outer walls of the cooling tower. Fig. 2 shows a diagrammatic arrangement of connections of the heat-exchanger pipes. These are so arranged that in case of the outside temperature being below 32 deg. F. and when the steam consumption by the turbine is too small, the tubular system can be rapidly emptied. Moreover, care has to be taken that the plant can be filled with water if the cooling plant has been previously emptied. Without circulation of the cooling water the required vacuum cannot be produced in order to start the turbines, so that also in this case certain difficulties have to be overcome to avoid the freezing of the cooling water when the atmospheric air is below 32 deg. F. The exhaust steam leaves the turbine through the exhaust pipe connector (8) and flows into the mixing condenser (9), into which cooling water is sprayed through one or more nozzles (10). The water leaves the mixing condenser (9) through the pipe (11), whereupon a portion of the water is supplied by the pump (12) and the pipe (24) to the boiler (not shown) and the other portion is transferred through the pipe (25) and pump (26) to a lower collecting chamber (27). Two pipes (28) ascend from the lower right-hand side of the collecting chamber (27) to an upper collecting chamber (29). With the pump (26) running, the valve (24) being open and the valves (16 and 17) being closed, the cooling water flows upwards in both pipes (28) forming a group, and it returns through pipes (20) forming a second group to the second collecting chamber (31) below, then flowing through the open valve (13) and the pipe (34) to the spraying nozzle (10) of the mixing condenser (9). The form of construction shown in Fig. 3 shows an air-cooling apparatus, which diners from the one shown in Fig. 2 in so far as all the pipes (35) of the heat-exchangers are passed by the water as it flows in one direction, from bottom to top. In this case a collecting chamber (37) common to all the pipes (35) is provided at the lower part of the heat-exchanger. The upper collecting chamber (29) is connected through a pipe (36) and the pipe (34) with the nozzle (10) in the mixing condenser (9). In normal operation, the cooling-water flows in the pipe (36) downwards to the nozzle (10), through the open valve (13), whilst the valves (16, 17 and 18) are closed. Moreover, for the purpose of setting for normal operation, and also for the filling up or emptying of the system, the valves (13 to 18) are set as described in the case of Fig. 2. Fig. 4 shows a further form of construction in which measures are taken to ensure that, when filling, as well as during operation, the removal of the air is accelerated or ensured. *British Patent No.* 809,510 *issued to Licencia Talamanyokat Ertekesitoe Vallalat, Budapest. Complete specification published February 25th*, 1959.

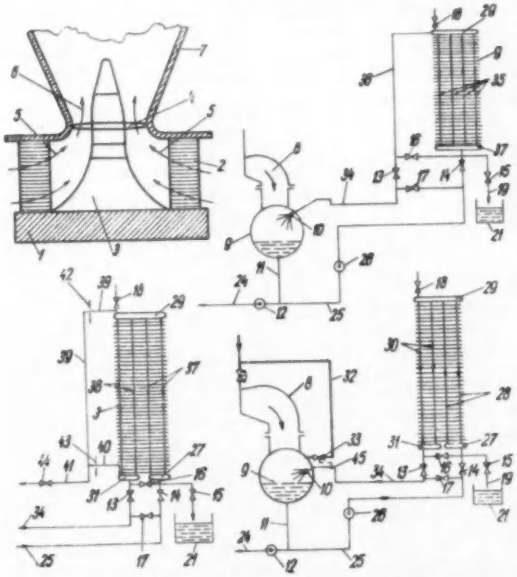


Fig. 1 (top, left).
Fig. 2 (bottom, right).
Fig. 3 (top, right).
Fig. 4 (bottom, left).
British Patent No. 809,510.

Steam generator in pressure-resistant cylindrical casing

This invention relates to steam generators and especially to waste-heat boilers, having a pressure resistant cylindrical casing within which a number of heating surface tube groups are arranged in rectangular formation leaving segmental free spaces between the casing and the tube groups. According to the invention it is proposed to arrange the admission and discharge ducts for a steam drum and/or the heating surface tube groups in the segmental free spaces between the casing and the tube groups, and for the ducts to support such groups. The waste-heat boiler shown in Figs. 5, 6 and 7 is surrounded by a cylindrical casing (1). The contact heating surface consists of three evaporator tube bundles (2, 3 and 4). The evaporator tubes of each bundle are corrected to manifolds (5) and discharge into headers (6). The tubes themselves are bent in sinuous fashion, the individual turns ascending

slightly. The heating surfaces fill a rectangular cross-section in the cylindrical casing, as will be seen from Fig. 6. The spaces of segment-like cross section (7 and 8) are left between the heating surfaces and the cylindrical casing. In the spaces (7) are arranged two downpipes (9) and two steam-water mixture discharge ducts (10), discharging at the top end into a steam and water drum (11).

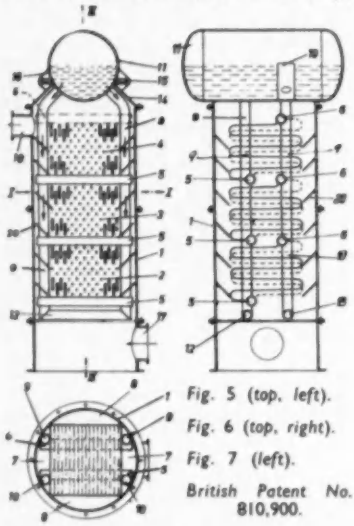


Fig. 5 (top, left). Fig. 6 (top, right). Fig. 7 (left). British Patent No. 810,900.

At the bottom, the down-pipes are connected together by a horizontal pipe (12) and the discharge pipes by a pipe (13), so that the down-pipes and discharge pipes form a U-shaped frame suspended from the drum (11). The manifolds (5) are connected to the down-pipes (9) and the headers (6) to the discharge pipes (10). The entire heated tube system is carried by the two U-shaped frames formed by the down-pipes and the discharge pipes. The drum (11) is supported on the thick walled cylindrical casing (1). For this purpose, brackets (15) are welded to the hood (14) of the casing and the drum (11) rests on the brackets by means of feet (16). This construction of the waste-heat boiler has the advantage that the cylindrical casing and the heated tubes can expand independently of each other. The waste gases enter the boiler through the lower connection (17) in the direction of the arrow, and leave again through the upper connection (18). To avoid the steam generated having to pass through the water contained in the drum (11), an extension (19) for leading the steam-water mixture above the level of the water is mounted on the discharge pipes (10) within the drum. To prevent the waste gases from by-passing the heating surfaces through the side spaces (7 and 8), the latter are covered by a series of plates (20). In the spaces (8), the plates are fixed directly to the cylindrical wall (1), but in the spaces (7), they are fixed to the downpipes (9) and discharge pipes (10). After detaching the hood (14), the entire heating surface can be taken out upwards with the drum (11). *British Patent No.* 810,900 *issued to H. Vorkauf. Complete specification published March 25th*, 1959.

Economiser with washing arrangement

This invention relates to heat-exchangers such as economisers for steam boilers, and comprises an improved arrangement designed to permit on-load washing. With the usual arrangement of flue or duct connections employed, the successful operation of on-load washing is prevented by the danger of entrainment of wash water into the dust-collectors, or induced-draught fans, and subsequent damage to these units. According to the invention, the duct for the flue-gases is divided into two or more channels having separate washing means. There are separately controlled flue-gas outlets and a common separating-chamber. The arrangement is such that the entrainment of wash water with the outflowing gases from a channel in

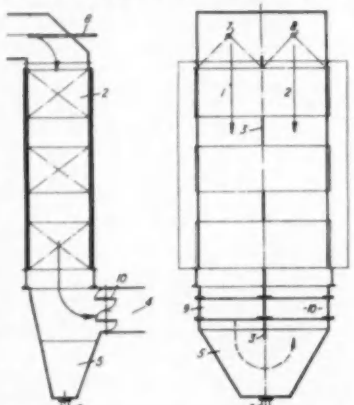


Fig. 8 (left). Fig. 9 (right). British Patent No. 810,262.

which the tubes are being washed can be prevented by constraining the outflowing gases from that channel to pass through a separating chamber before escaping to the outlet of an adjacent channel. By this arrangement on-load washing of the tubes can be successfully carried out by washing the tubes in one channel at a time. In Figs. 8 and 9 the economiser (or air-heater) is divided into two separate channels (1 and 2) by means of a vertical partition plate (3) which extends to a level below that of the gas outlet connection (4), and thus projects into a separating-chamber formed by the lower ends of the channels (1 and 2) and a drainage-hopper (5), the drainage-hopper and a drain (6) being below the partition (3). Each compartment (1 and 2) is provided with separate sprayers (7 and 8) together with outlet dampers (9 and 10). When one compartment, for example (1), is to be washed, the outlet damper (9) for the compartment is closed, the damper (10) for the other department (2) being maintained in the fully-open position. The gases flowing down through the compartment (1) being washed are thus constrained to make a 180° turn into the other compartment (2) by means of the vertical positioned plate (3). The stream of wash water flowing down from the sprayer (7) at high velocity is thereby separated from the gas stream and is carried into the hopper drain (6). A similar sequence is arranged for the washing of the other compartment (2) when the positions of the dampers (9 and 10) are reversed, the damper (10) for the other compartment being in the closed position and the other damper (9) being open. *British Patent No.* 810,262 *issued to E. Green & Son Ltd. Complete specification published March 11th*, 1959.

Steam generator

This invention relates to water-tube steam boilers in which the supporting frame is formed by unheated downcomer pipes and cross-pipes connecting the downcomer pipes, and in which the cross-pipes may simultaneously serve as distributors or collector headers for steam generating riser tubes. The steam and water drum (1) of the boiler shown in Figs. 10, 11 and 12, rests on two downcomer pipes (2 and 3) which are connected together at the bottom by a cross pipe (4). Three further downcomer pipes (5, 6 and 7) pass from the drum to the cross pipe. As will be seen in Fig. 11, the pipes (5 and 7) can be bent towards the centre so that greater lateral stiffness is obtained. Instead of the form illustrated, the pipes can also cross one another. It is possible for the pipes to run straight down; this gives a certain lateral stiffness. In the construction shown in Fig. 12, where the pipes (5 and 7) are bent outwardly and attached to the main downcomer pipes (2 and 3), there is also the advantage that the downcomer pipes (2 and 3) are stiffened against bending. When the cross pipe (4), according to Fig. 10, is constructed as a distributor for the front wall steam generating rise tubes (8), the pipes

(5, 6 and 7) relieve the two downcomer pipes (2 and 3) in that the greater part of the water flows to the cross distributor (4) through the pipes (5, 6 and 7), and hence water flowing through the pipes (2 and 3) can flow directly, without branching, to the bottom distributor, thus not only limiting the actual volume of flow but also enabling eddy-free flow to be obtained in the pipes (2 and 3). However, even with a cross-pipe which is not constructed as a distributor, more favourable flow conditions occur since the water has to flow along the cross-pipe (4) and into the down-pipes (2 and 3), and therefore the speed of in-flow at the top of the drum is reduced and the boiler is more insensitive to a pressure fall.

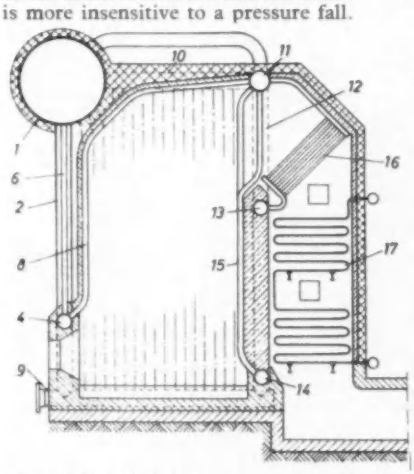


Fig. 10 (left). British Patent No. 812,442.

The side wall tubes start from the longitudinal distributor (9) and lead into a top longitudinal collector (10). The front wall tubes (8) lead into a collector (11), from which two return tubes (12) lead to cross distributors (13 and 14). The return tubes (12) are in communication with the longitudinal distributor (9). The back wall tubes (15) are connected to the distributor (14), and the evaporator tube elements (16) are connected to the distributor (13). An economiser (17) is arranged in the convection zone. *British Patent No.* 812,442 *issued to H. Vorkauf. Complete specification published April* 22, 1959.

Steam generator unit

This invention relates to steam generating units for generating steam by heat extracted from hot fluids. The unit (10) shown in Figs. 13, 14 and 15 comprises a vertically elongated pressure vessel (12) closed at the ends by a lower hemispherical head (16) and an upper convex head (14), arranged with a manhole opening (18). During normal operation of the unit there is a normal liquid level (22) which forms an upper steam space (24) and a liquid space (26). Plates (28, 30, 32 and 34) in conjunction with the walls of the pressure vessel (12) form a steam generation chamber (36) and an annular downcomer (38). The steam generation chamber (36) is vertically elongated and is of circular cross-section less than the cross-section of the pressure vessel. The baffle plate (34) is joined to the plate (32) so that the upper portion of the steam generation chamber is essentially hemispherical. The hexagonal cap-plate (28) and the plate (30) form an extension chamber (40) shaped as a six-sided regular prism for the collection of the water-steam mixture. Within the chamber (36) there are a number of U-shaped tubes constituting a vertically elongated tube bundle (42) filling the lower portion of the steam generating chamber. A tube sheet (44) is located transversely of the longitudinal centre-line of the pressure vessel (12) and has a number of tube seats (45). Tube ends of the U-shaped tube bundle (42) pass through the tube sheet (44) and are fastened in the tube seats for the flow of a hot heating fluid through them. The hemispherical head (16) is fastened to the outer edge of the tube sheet to enclose the outer face and form, in conjunction with a dividing baffle (48), a heating fluid inlet chamber (50) and an outlet chamber (52). Inlet and outlet nozzles (54 and 56) provide the means for passing the heating fluid into the inlet chamber (50), through the tubes of the tube bundle (42) and out through the outlet chamber (52) to the outlet nozzle (56), where the fluid is cooled. Six hollow upright whirl-chamber-type separators (58) are arranged in a ring in the upper portion of the pressure vessel to receive a steam-water mixture which is emitting radially outward from the outlets (60) of the collecting chamber (40). Each of these separators has an upper whirl-chamber portion and a lower downflow portion with a length to diameter ratio of approximately 6 : 1, and with the whirl-chamber portion being less than half of the total length. The whirl chambers (58) are arranged so that the normal liquid level (22) is positioned in the upper one-third of the height of the separator. Further, each separator has an outwardly directing extension piece (62) at the liquid discharge end, which is arranged to direct the separated liquid into the downcomer (38) outside the tube bundle (42). Separated steam passes out of the upper end (64) of the steam-water separators, through a corrugated-type steam scrubbing element (66) and then through the steam outlets (68) to a point of use. The make-up feedwater enters by the inlet pipe (70) and is discharged into the collection chamber (40) via a direct contact heating arrangement

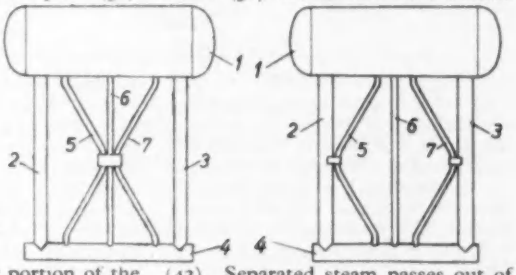


Fig. 11 (right).

Fig. 12 (extreme right). British Patent No. 812,442.

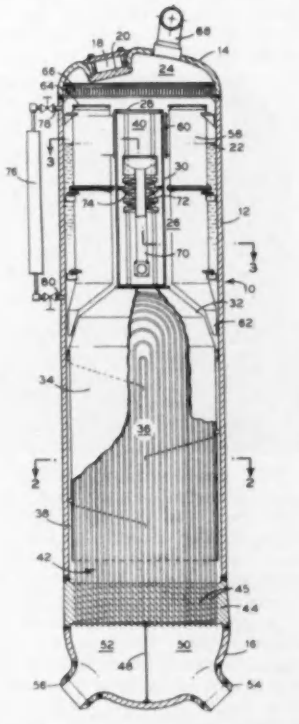


Fig. 13. British Patent No. 812,500.

(72). This contact heating arrangement is provided with a number of alternately inclined, perforated trays (74) so that under certain operating conditions when the chamber (40) may be largely filled by steam, the feedwater will be heated to a point near saturation by the condensation of the steam before passing into the separators. A liquid level indicating device (76) is arranged with taps (78 and 80) through the side of the vessel, to indicate the position of the liquid level. Among the heating fluids mentioned are petroleum, liquid metal, water or gas. *British Patent No.* 812,500 *issued to The Babcock & Wilcox Company, U.S.A. Complete specification published April 29th,* 1959.

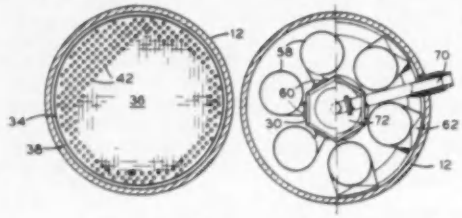


Fig. 14 (extreme left).

Fig. 15 (left). British Patent No. 812,500.

KELVIN HOUSE

In order to simplify administration and exchange of information between companies and to draw together and combine their competitive resources, a co-ordinating board has been set up to direct the policy of the Aviation, Marine and Industrial Divisions of S. Smith & Sons (England) Limited. These companies include Smiths Aircraft Instruments Limited; Waymouth Gauges & Instruments Limited; Kelvin & Hughes Limited and subsidiary companies; and that part of the business of S. Smith & Sons (England) Limited devoted to the manufacture or sale of aviation and allied products. The administrative headquarters of these divisions will be at Kelvin House, a new office block formally opened by Sir David Eccles, K.C.V.O., M.P., the President of the Board of Trade, on May 4th.

The new building, which cost approximately £250,000, fronts Wembley Park Drive, and adjoins the Olympic Way entrance to the Wembley Stadium which stands on the hill overlooking Kelvin House. Designed in contemporary style, the structure is supported on 190 reinforced-concrete piles. It presents a curved glazed facade of seven storeys, rising to a height of 85-ft. and enclosing a floor space of nearly 50,000 sq. ft. of office accommodation. Principal features of the building include tower staircase windows running the full height of the east elevation, with relieving panels of blue vitreous enamel; a pavonazzo marble-paved entrance hall, flanked by a mosaic colonnade; and first floor treatment in silk-screened design on plyglass panels. The architects were T. P. Bennet & Son, and the main contractors Taylor Woodrow Construction Co. Ltd.

An exhibition staged at Kelvin House at the time of the official opening included instruments for automatic boiler control, flue gas analysis, draught control and measurement, smoke density equipment, and other products ranging from electronic gear, such as precision radar, to precision gyroscopes and manometric instruments and automatic pilots, down to the relatively more simple instruments such as tachometers and industrial flow-meters.

G. & J. Weir Limited have received an order from the Government of Kuwait, Oil Sheikdom on the Persian Gulf, for what will be the largest "fresh water from sea water" plant in the world. The plant, of the Weir "Multiflash" type, consists of two units, each of which will produce one million gallons of fresh water a day—the greatest output ever achieved by a single-flash distillation unit. The order is valued at well over half a million pounds, and it was obtained in the face of strong international competition. This follows last year's interesting order for a similar Weir plant for half a million gallons a day in Guernsey, and confirms the Scottish company's commanding lead in this field of engineering. Weir distillation plant installed, and on order, will now give a total output of 10½ million gallons of fresh water per day—a quantity well over three-quarters of the world's total output from land installations. The Weir "Multiflash" design is the outcome of the company's vast experience since 1884, and the numerous export orders for their plant in the Middle East and the Caribbean have made a significant contribution to the prosperity of Scottish industry. Since the receipt of the Guernsey order last year, great interest has been shown in the "Multi-flash" process, and enquiries are arriving almost daily at the company's headquarters.

SMOKE DENSITY EQUIPMENT

Electroflo Meters Co. Ltd. first supplied smoke density equipment, complete with alarms, for installation at the head office of the Midland Bank Limited, Poultry, E.C.2, some 20 years ago. This initial set has operated with complete satisfaction to all concerned over this period. A second set was purchased in 1956, and a third similar set of Electroflo smoke density equipment is now to be installed. The initial capital cost of instrument equipment is a question which often weighs heavily in the mind of the purchaser, but if the equipment is to give a generation of satisfactory service, and to enable the user to comply with the stringent requirements of the present day, concerning "The Clean Air Act," then quality, robustness, accuracy and reliability are always worth the slight extra cost. In the Electroflo smoke density indicator, recorder and alarm unit, the light projector and a photo-electrical receiver are arranged on diametrically opposite sides of the chimney stack. The beam is focused on to the face of a self-generating photo-electric cell, and the e.m.f. generated by the cell is proportional to the intensity of light which falls on it. This light intensity, in turn, is proportional to the amount of smoke obscuring the light from the projector. The e.m.f. operates a galvanometer in the reading instrument producing a deflection over a Ringelmann or "percentage obscuration" scale. The reading instruments can be of the indicating and/or recording type, and contacts may be fitted to provide visible and audible warning when excessive smoke is produced. Full details of the equipment are given in a leaflet (No. 64A) which can be obtained from Electroflo Meters Co. Ltd., Abbey Road, Park Royal, London, N.W.10.

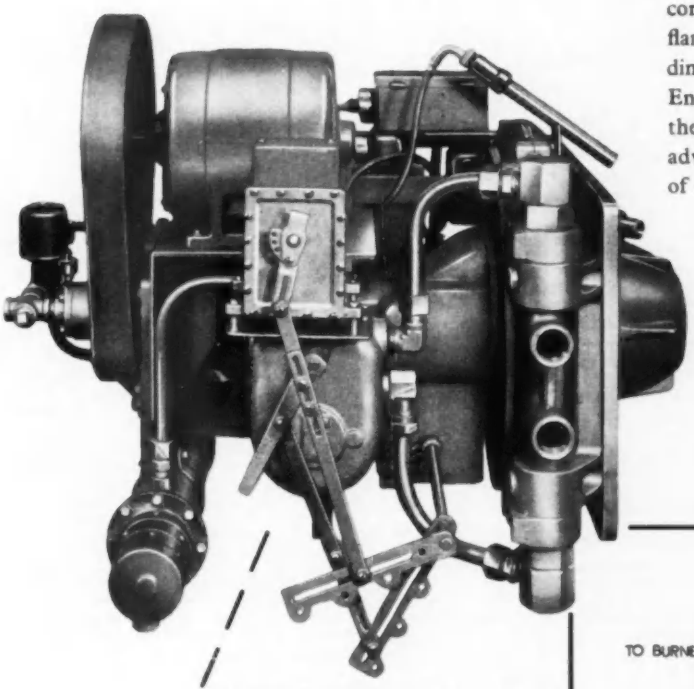
An entirely new edition of "The Stoker's Manual" is now being published by the **National Industrial Fuel Efficiency Service,** price 2s. 6d. This new manual gives all the latest information on oil-firing, the Clean Air Act and the prevention of dark smoke emission, and the mechanical firing of Shell-type boilers with coal. In addition, the information contained in the original "Stoker's Manual" has been brought up to date. Every stoker and anyone responsible for the control of a boiler plant will find it well worth while to obtain a copy of the new manual.

ANNOUNCING THE

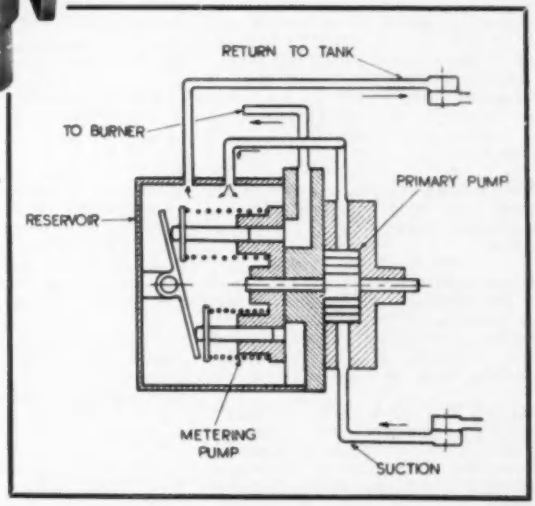
SWINNEY ENTERPRISE

Automatic Rotary Oil Burner

Swinney-Enterprise Rotary Oil Burners are now available in a range of 12 sizes having outputs from 3.5 gallons per hour to 166 gallons per hour and are suitable for use with the heaviest grades of fuel. Burners are available for operation on natural, induced or forced draught and with a wide variety of control systems. By correct choice of combustion head, flame shape can be altered to suit the dimensions of the combustion chamber. Entirely manufactured in the U.K. the Swinney-Enterprise is the most advanced oil burner for firing all types of steam and hot water boilers.



The Measured Rate Metering Pump is exclusive to Swinney-Enterprise burners. Regardless of grade, viscosity or temperature of fuel the metering pump will provide the correct flow of fuel to ensure precise air/oil ratio and efficient combustion.



FOR FURTHER INFORMATION WRITE OR PHONE:—

SWINNEY BROTHERS LTD

MORPETH, NORTHUMBERLAND. Tel: MORPETH 92/3

LONDON: 34 CRUTCHED FRIARS E.C.3. Tel: ROYAL 2977

NOTES Personal AND Industrial

Lord Strathclyde has been appointed chairman of the North of Scotland Hydro-Electric Board (to hold office from July 1st, 1959, to June 30th, 1962) in succession to the **Rt. Hon. Thomas Johnston.**

* * *

Mr. R. S. Hewitt has been appointed to the board of Elliott Brothers (London) Ltd. He started his career with Elliott Brothers in 1928, and is deputy controller of Elliott-Automation Limited.

* * *

Mr. J. M. Storey, C.B.E., managing director, Dewrance & Co. Ltd., left for the U.S.A. on May 7th to attend the World Petroleum Congress in New York, and also the Tulsa Oil Show. He is also visiting Canada to renew contacts made when he led the Economic, Technical and Goodwill Mission to the Canadian Petroleum and Allied Industries during May and June, 1957. Dewrance & Co. Ltd. is exhibiting at the National Industrial Production Show, Toronto, and Mr. Storey will, together with the company's agents—F. S. B. Heward & Co. Ltd.—be available for discussing the supply of Dewrance equipment.

* * *

It is with regret that we record the death at Rugby recently of **Mr. K. R. Hopkirk,** who until he retired on December 31st, 1958, was director and chief mechanical engineer of the British Thomson-Houston Company.

* * *

Atomic Power Constructions Limited announces that the first phase in the development of its research laboratories at Heston, Middlesex, has been completed. Dr. R. J. Eldred, M.I.Mech.E., has returned to head office to continue his normal duties, and the permanent laboratory executives appointed at Heston are, Mr. H. E. Dixon, head of research and development, and Dr. A. G. H. Coombes, deputy head of laboratories. Mr. D. C. F. Lunn has been appointed chief metallurgist to fill the vacancy created by Mr. Dixon's appointment.

* * *

Mr. W. Hackett, Jnr. and **Mr. R. D. Young,** have been appointed assistant managing directors of Tube Investments Limited.

* * *

Elliott-Automation Limited announces that **Mr. Donald M. Hughes,** export sales manager of the Fisher Governor Company, has joined James Gordon Valves Limited, of Airport Works, Rochester, Kent, as sales manager.

* * *

Mr. M. E. Peplow, B.Sc., A.Inst.P., A.M.I.E.E., formerly senior assistant engineer at the Leatherhead Research Laboratories of the Central Electricity Generating Board, has been appointed Regional Research and Development Officer for the Southern, South Western and South Wales Region of the Board.

Mr. E. C. Scott, B.Sc. (Eng.), M.I.E.E., system operation engineer of the North Eastern Division of the Central Electricity Generating Board, has been appointed system operation engineer at the Board's headquarters. On April 1st, 1948, Mr. Scott was appointed as the engineer responsible to the system operation engineer at headquarters, and held this position until March 1st, 1951, when he acted as personal technical assistant to Sir John Hacking. On March 17th, 1953, he joined the North Eastern Division as system operation engineer, the post he relinquishes to take up his present appointment.

* * *

Mr. John C. Hanna, Jnr., general manager, has been appointed an additional director of C. R. Averill Limited. In pursuance of their consolidation and extension policy, the company have recently introduced a number of new products in their range of paints and have arranged for country-wide distribution of their well-known Avarc Graphite specialities through main distributors in all parts of the country.

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Short & Mason Limited announce that **Mr. W. K. Gregson** has joined the company as Northern area representative, and will operate from 32, Park Road, Sale, Cheshire.

* * *

Mr. P. K. Davis, M.I.E.E., formerly transmission engineer (construction) of the Eastern Division of the Central Electricity Generating Board, has been appointed divisional electrical engineer of the Division. From 1948 to 1955 Mr. Davis held the position of senior assistant transmission engineer (construction) of the Eastern Division, following which he became transmission engineer until taking up his present appointment.

* * *

Dr. W. Steven, superintendent of the Development and Research Department Laboratory of The Mond Nickel Co. Ltd., in Birmingham, was transferred on June 1st to the Development and Research Division of The International Nickel Company, Inc., New York, as director of research. He has also been elected an assistant vice-president of that company. **Dr. G. L. J. Bailey** has been appointed to succeed Dr. Steven in Birmingham.

* * *

Mr. J. F. Begley, who has for the past three years been sales manager of Plibrico Co. Ltd., refractory engineers, Westmorland Road, London, N.W.9, has been appointed a director of the company.

* * *

Mr. P. T. Thornhill, B.Sc. Tech., A.M.I.E.E., has been appointed assistant chief engineer (Contracts), Switchgear Department of Metropolitan-Vickers Electrical Co. Ltd.

It is with regret that we record the death, at his home, Broadwas Court, Broadwas-on-Teme, Worcester, on May 4th, of **Mr. J. O. Twinberrow,** until recently the secretary of the Boiler Availability Committee. Mr. Twinberrow was from 1932-1950 manager of the publicity department of Babcock and Wilcox Limited, having been in the employment of that company since 1920. On the formation of the Boiler Availability Committee in 1939, Mr. Twinberrow's services were seconded to the committee by Babcock and Wilcox Ltd., and on his retirement from their employment at the end of 1950, he became full-time secretary of the committee. Mr. Twinberrow retired from this position at March 31st 1959.

* * *

Mr. G. W. Grossmith has been appointed chairman, and **Lt.-Col. Eric Ward,** A.M.I.Mech.E., managing director, of Strachan and Henshaw Limited.

* * *

Mr. Victor Brenner has been re-elected president for the fourth year and **Mr. C. J. Grazebrook** and **Mr. A. G. Banks** were re-elected vice-president and treasurer respectively of the Engineering Centre, Birmingham.

* * *

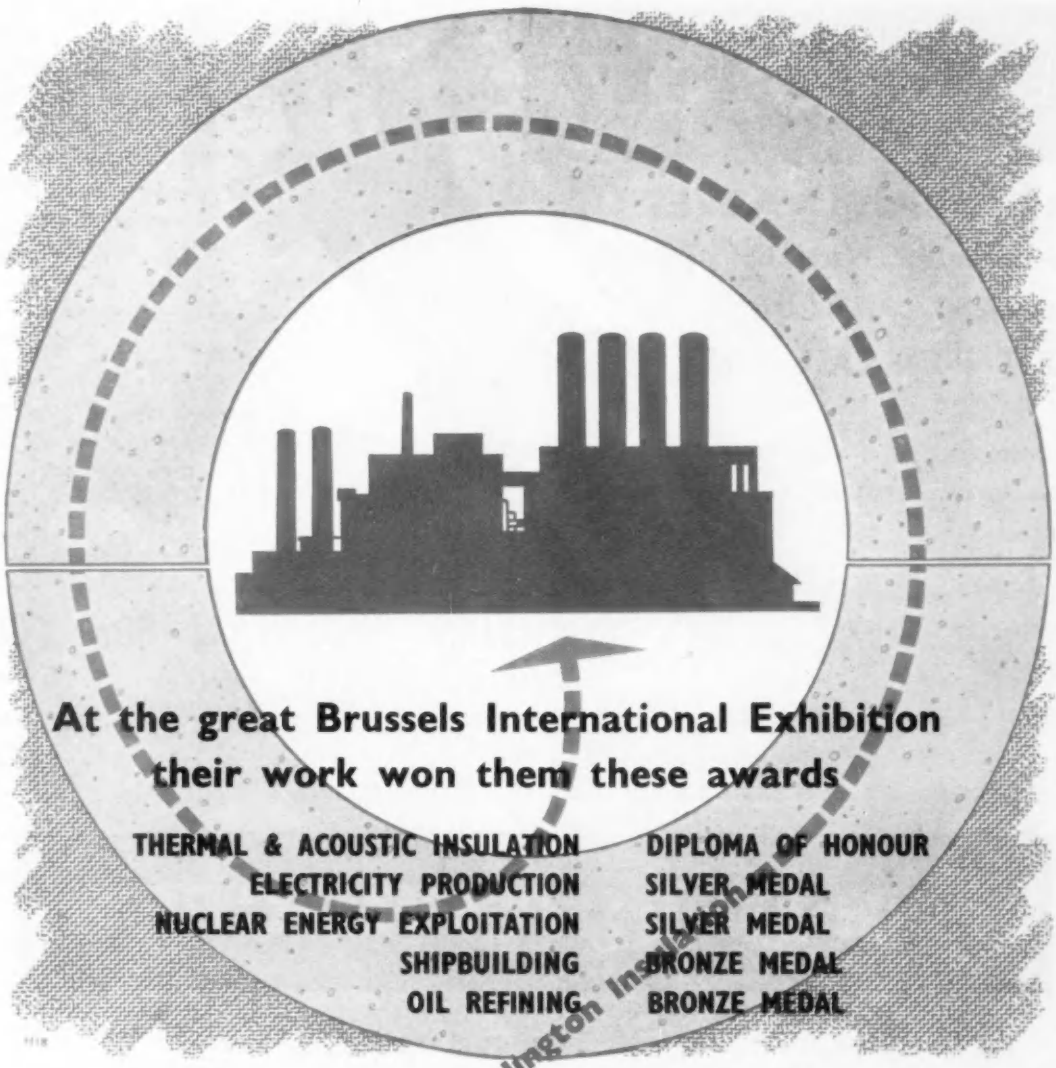
"Fuel Combustion Calculations" is the title of a new 20-page technical publication issued by **Charrington, Gardner Locket Co. Ltd.,** which should be of particular interest to users of large quantities of fuel. It contains graphs and formulae with comprehensive notes on their production and utilisation. Copies may be obtained from E. D. Charrington, Charrington, Gardner & Locket Co. Ltd., Tower House, 40, Trinity Square, London, E.C.3.

* * *

William H. Capper & Co. Ltd., Mayfair House, 8/9, Hertford Street, London, W.1 (tel.: Grosvenor 2341), have been appointed agents in the United Kingdom and Northern Ireland for Demag, of Duisburg, Western Germany. The equipment handled under this new arrangement includes mining equipment and compressors of all types for all capacities and pressures. Demag trained engineers are resident at the above address for advice and enquiries. William H. Capper & Co. Ltd. will undertake installation and service, and are equipped to design, fabricate and install associated pipework.

* * *

The first of five 210-MVA, 16.5/275-kV, 3-phase, 50-cycle generator transformers manufactured and fully-tested at the Stafford works of **The English Electric Company** for the High Marnham Power Station of the C.E.G.B., left the company's transformer works on Monday, April 20th. The transformers, each with a weight of 158 tons, are the largest yet shipped for the C.E.G.B.



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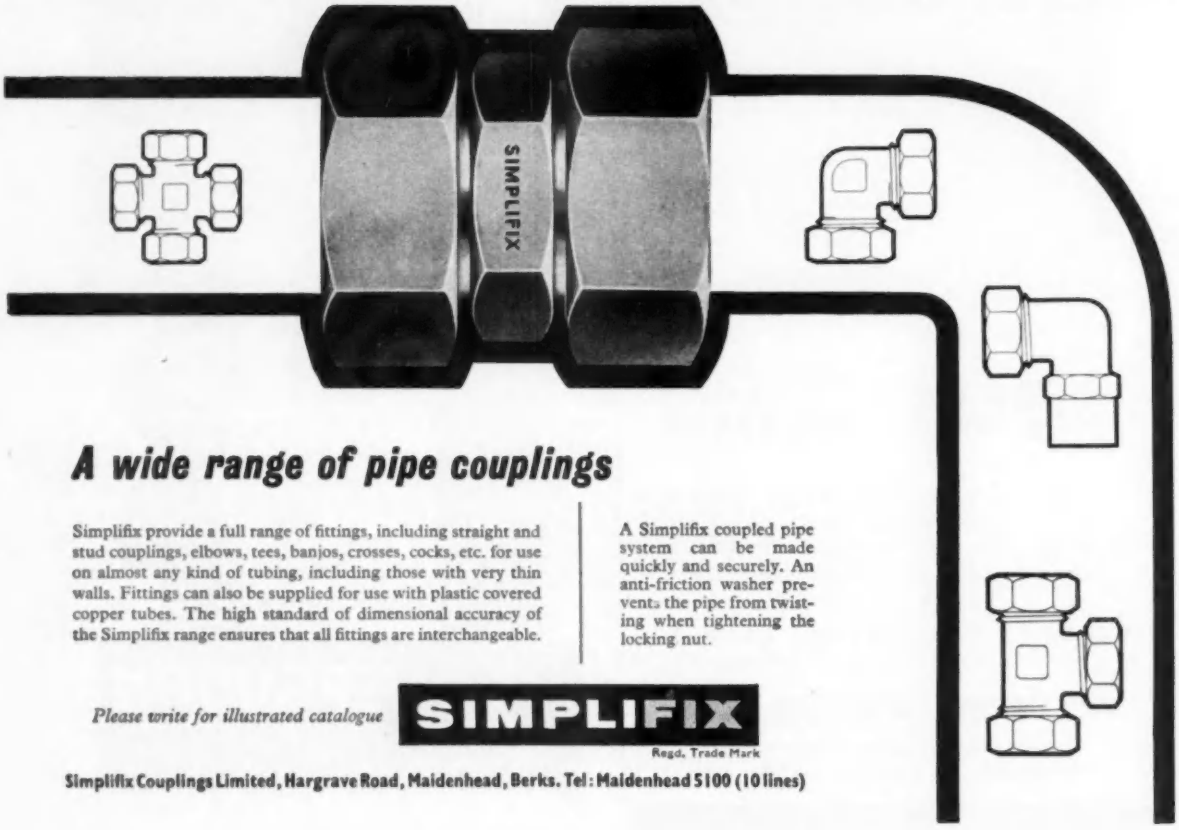

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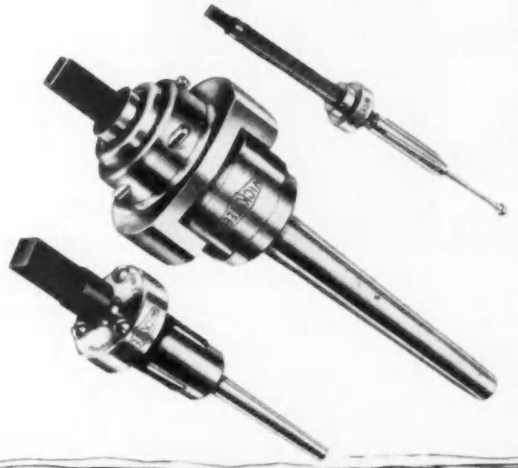

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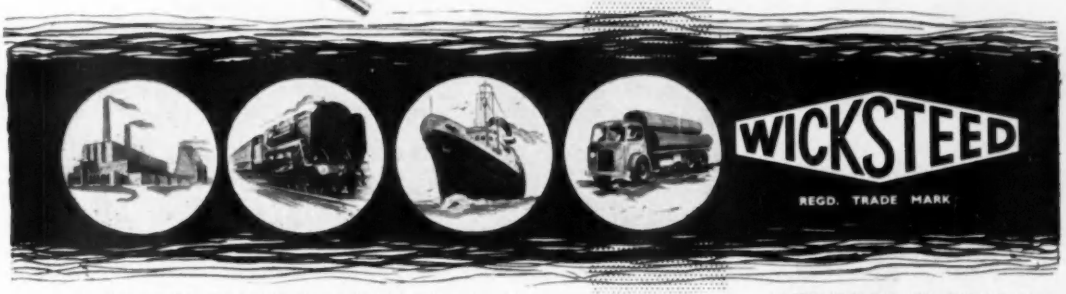

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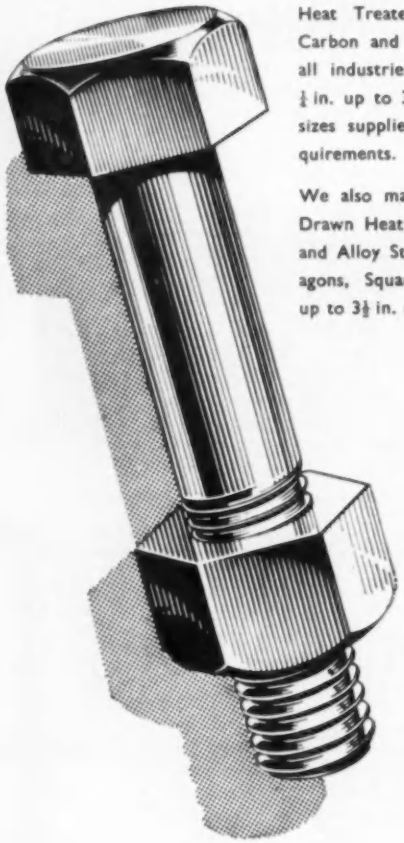

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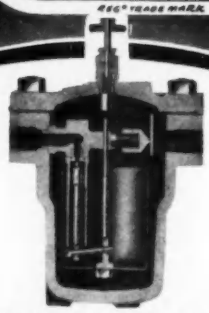

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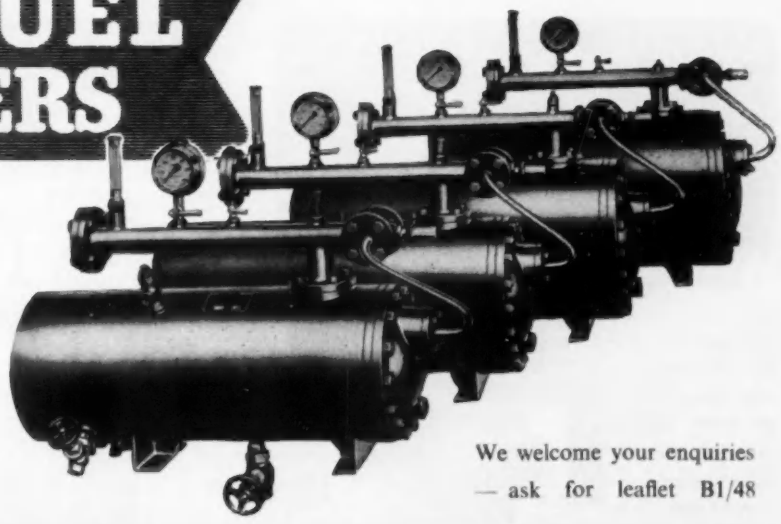

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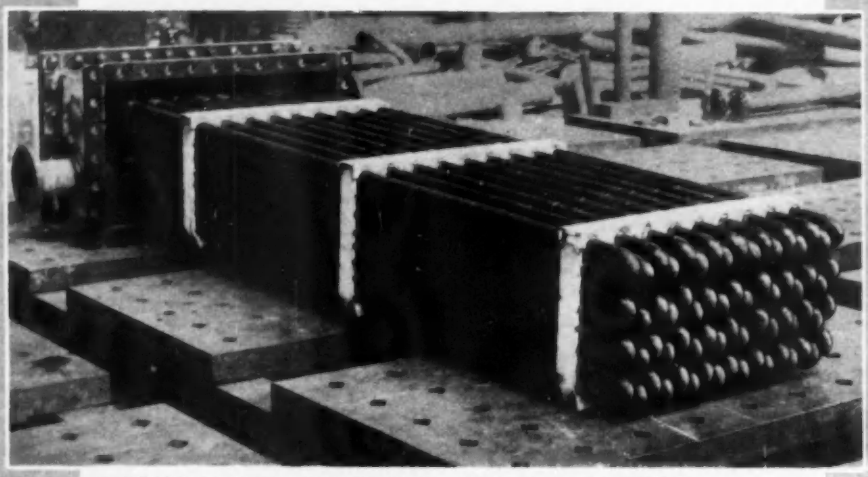

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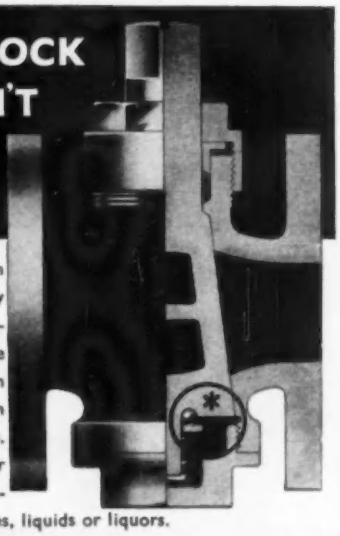

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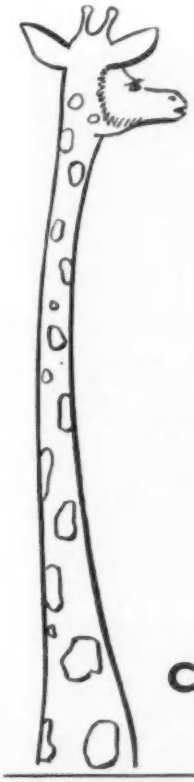

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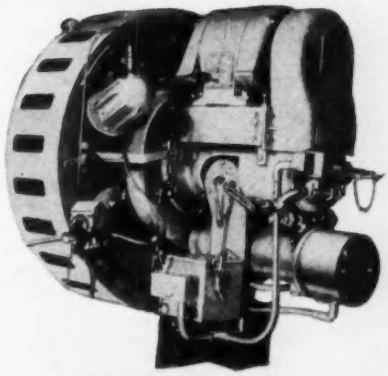

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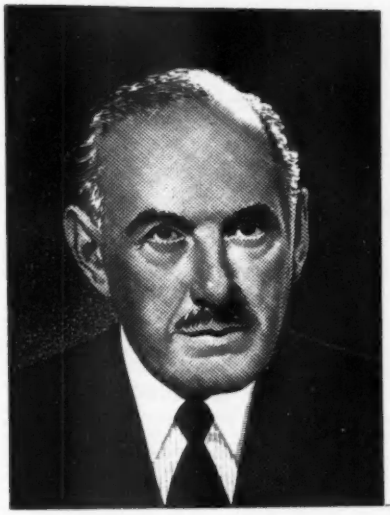

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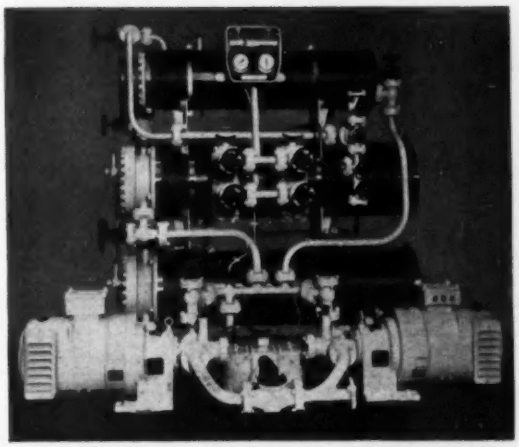

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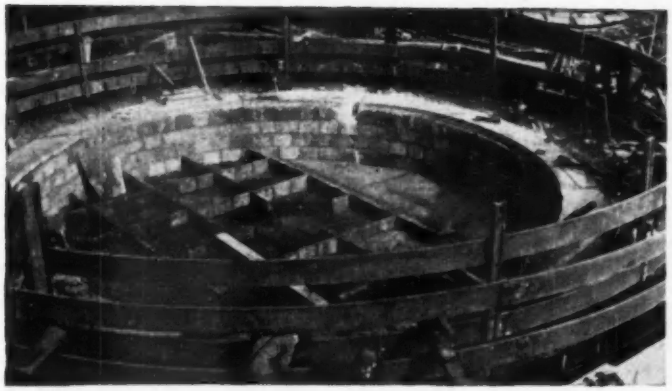

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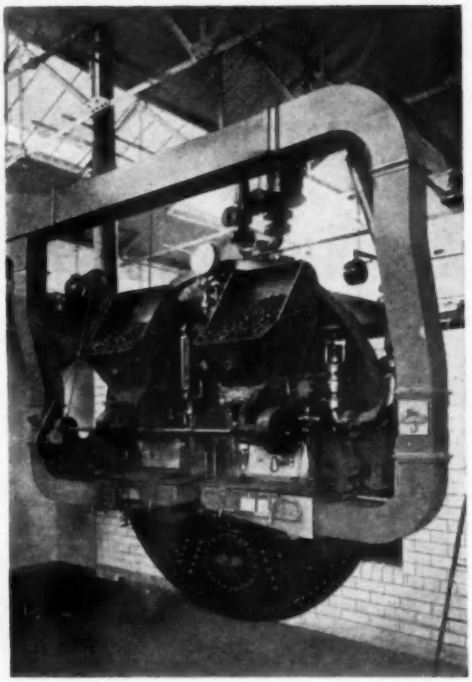

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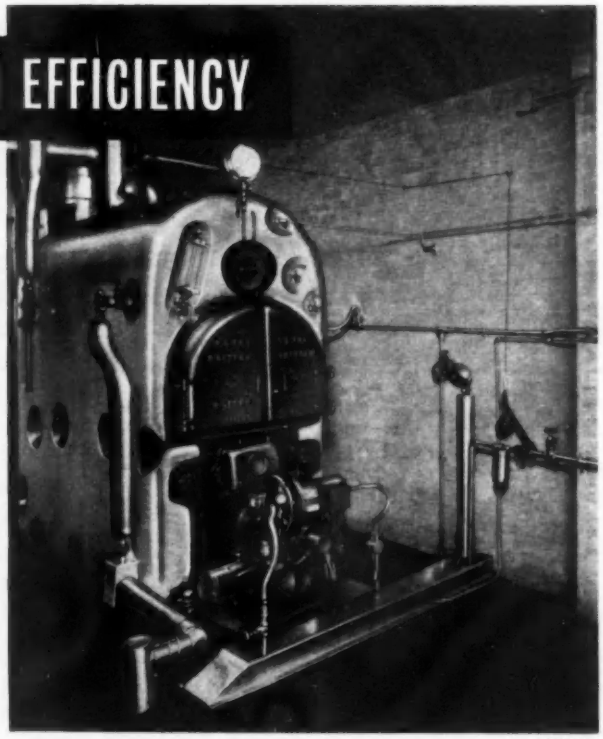

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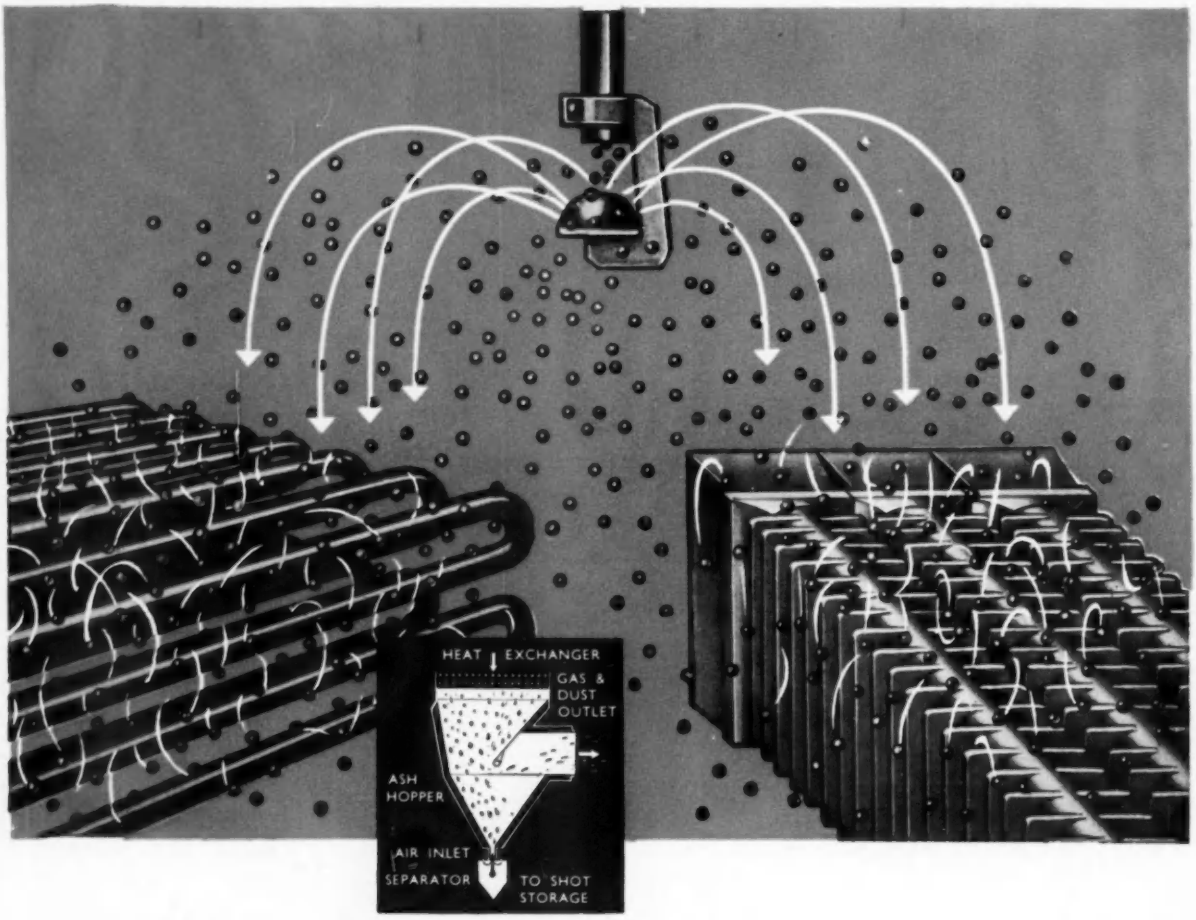

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